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COMMODORE

APRIL 1989 £1.30

GAMES REVIEWED:

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Soccer Simulator
Techno Cop
Robocop
Batman

BASEX – The ultimate Basic extension

Memory Mapping

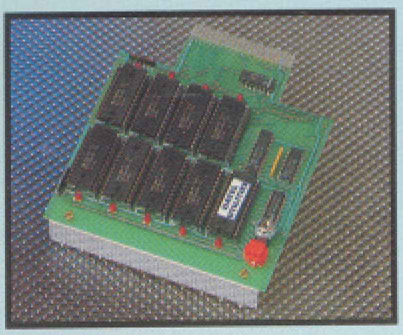
Teletext on the C64

SNAP SHOT! C64 cartridge reviewed

UNBEATABLE PROGRAMS:

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Array Storage ▲ Icon 64
C128 80 columns

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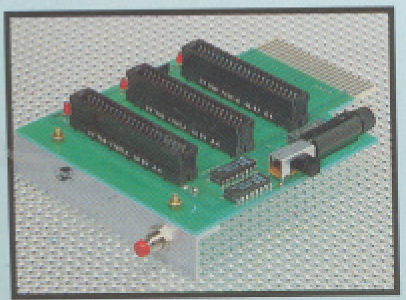
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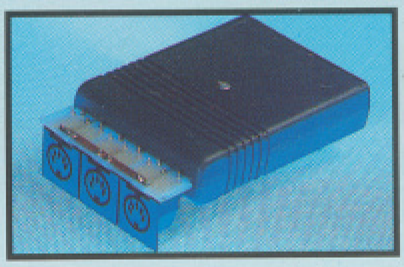


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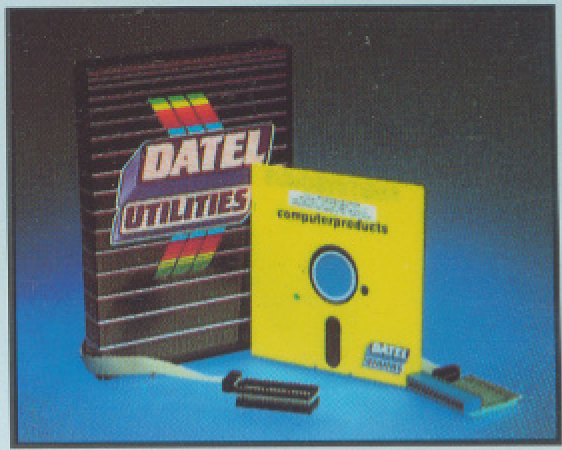
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- Wether to choose FastHack'em or Burst Nibbler? Fast Hack'em is unbeatable value as an "all rounder" - with nibblers, 1 or 2 drive copy, format, file copy, 1571 copy etc. etc., so if you have a more general requirement perhaps Fast Hack'em is for you. Burst Nibbler is a pure nibbler second to none, for the reasons stated. So if it's just making backups you are interested in, there is no other product to beat it!

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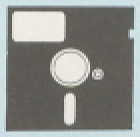
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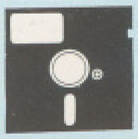
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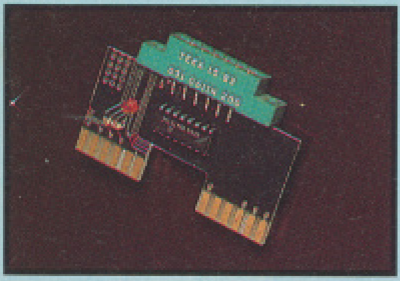


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- FAST DISK COPY - Copy an entire disk in 2 minutes or less using single 1541.
- FILE COMPACTOR - Can compact machine programs by up to 50%. Save disk space. Compacted programs run as normal.
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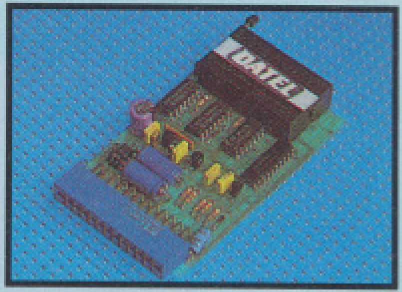
- 32K pseudo ROM.
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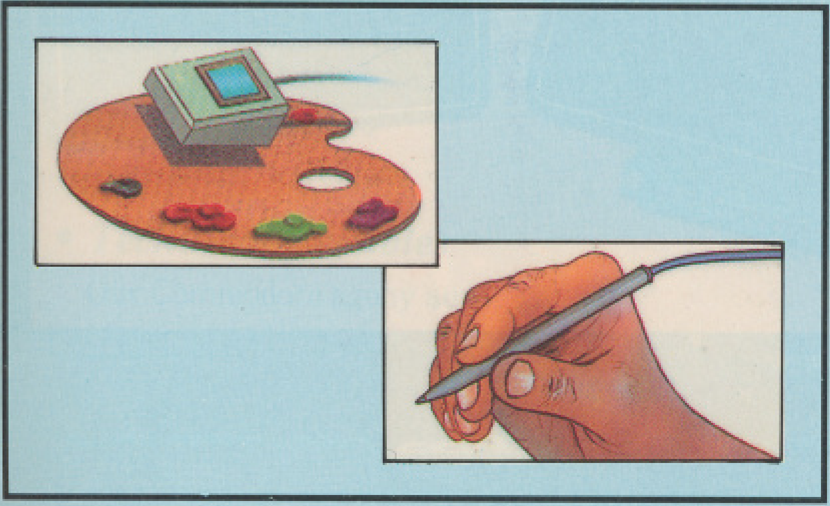
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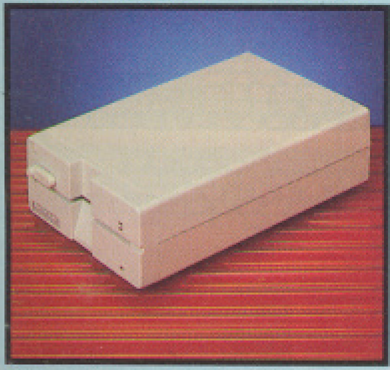
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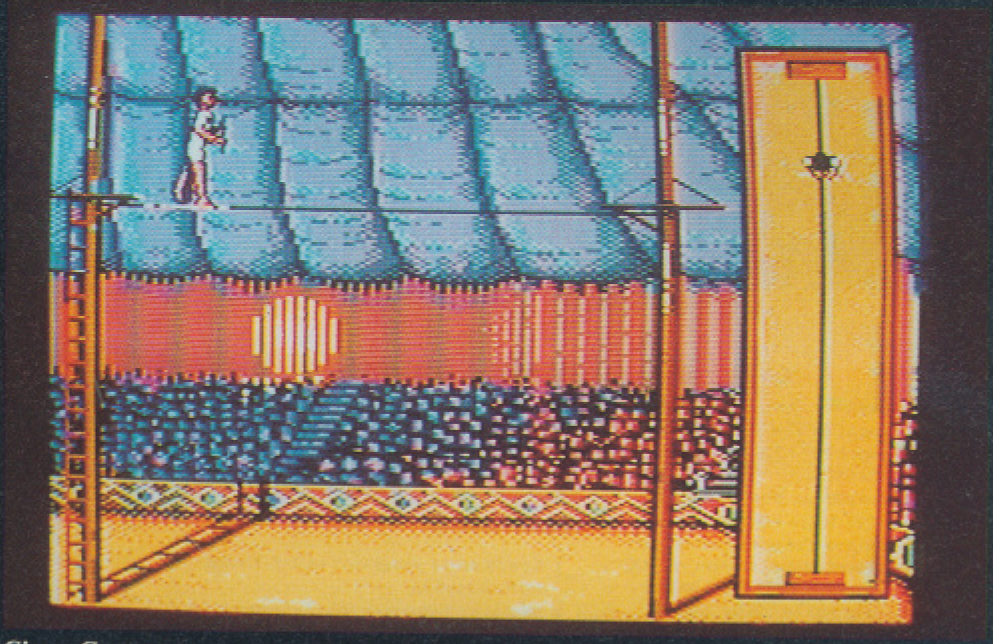
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NUMBER 7



Circus Games



The Microtext adaptor



Robocop

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ABC

Modem Moves

Modem Marketing is a new company which has been formed to sell Dataphone communications equipment to the UK's computer dealers. Principally this means that the Demon II (£79.95 + VAT) and Designer (£99.95 +VAT) modems should soon be given a higher profile.

The Demon II auto dial, answer and baud search can handle all of the common communications protocols but lacks the over-ride button, telephone socket and call progress monitoring facilities possessed by the Designer.

Touchline: *Modem Marketing, 611 Lincoln Road, Peterborough PE1 3HA.* ***Tel:*** *(0733) 52440.*

Space Horror

Project Firstart is the computer equivalent of a sci-fi, horror and suspense movie, according to its makers Electronic Arts. Replete with close-ups, fade-outs and other movie gimmicks, the game is available for the C64 (disk only) for £14.95.

A parting of the ways with EA has meant that Accolade has been trying to decide whether to go it alone in Britain or sign up with another American company such as Microprose. At the moment, no-one is talking, so watch this space...

Touchline: *Electronic Arts, Langley Business Centre, 11-49 Station Road, Langley, Slough, Berkshire SL3 8YN.* ***Tel:*** *(0753) 49442.*

Data Statements

Tele Ported



The new Microprose development team (clockwise from top left): Peter Moreland, Steve Perry, Tony Bickley and Paul Hibbard.

Three members of Telecomsoft have defected to the Microprose HQ in Tetbury. The trio of Steve Perry, Peter Moreland and Paul Hibbard have joined the company as part of the expansion drive initiated by company boss (Wild) Bill Stealey.

This swells the Microprose development team to four, which means that several British – made products should be appearing later this year.

A former magazine journalist, Martin Moth, has also been attracted to the company as its public relations manager and Martin Bull, erstwhile sales manager with Activision, is now doing the same good work for microprose.

Touchline: *Microprose, 2 Market Place, Tetbury, Glos. GL8 8DA.* ***Tel:*** *(0666) 54331.*

Jacko Peps Up Gold

US Gold are claiming to have signed a deal for the rights to the computer version of Michael Jackson's *Moonwalker*.

US Gold tried to climb on the Jacko bandwaggon by getting the maestro to add his magic touch to *Thunderblade*. The link with the pop star was their mutual dealings with Pepsi Cola but the plans came to nothing. The new deal is probably the biggest chance that US Gold have had for massive publicity and they're not ruling out the possibility of video tie-ins and extensive marketing.

The game is planned for release in autumn, but will US Gold hold it back for the Christmas rush so that they can regain their crown from Ocean? One thing's for sure, it'll cost them more than a monkey.

Touchline: *US Gold, Units 2/3, Holford Way, Birmingham B6 7AX* ***Tel:*** *021-356 3388*

Kingputers

A little bit of fun never hurt anyone, and our attention has been drawn to an amusing paperback of computer-based cartoons. Featuring the characters from the king Tutt strip cartoon, *Down With Computers* is packed with variations around the theme of ancient Egyptians and their abacus computers.

It may seem like a limited joke, but cartoonist Geoff Watson has managed to sustain the humour from cover to cover.

King Tutt – Down With Computers is published by Ravette Books (ISBN 1 85304 094 0) and costs £1.95.

Touchline: *Ravette Books, 3 Glenside Estate, Star Road, Partridge Green, Horsham, Sussex RH13 8RA.*

Footballs

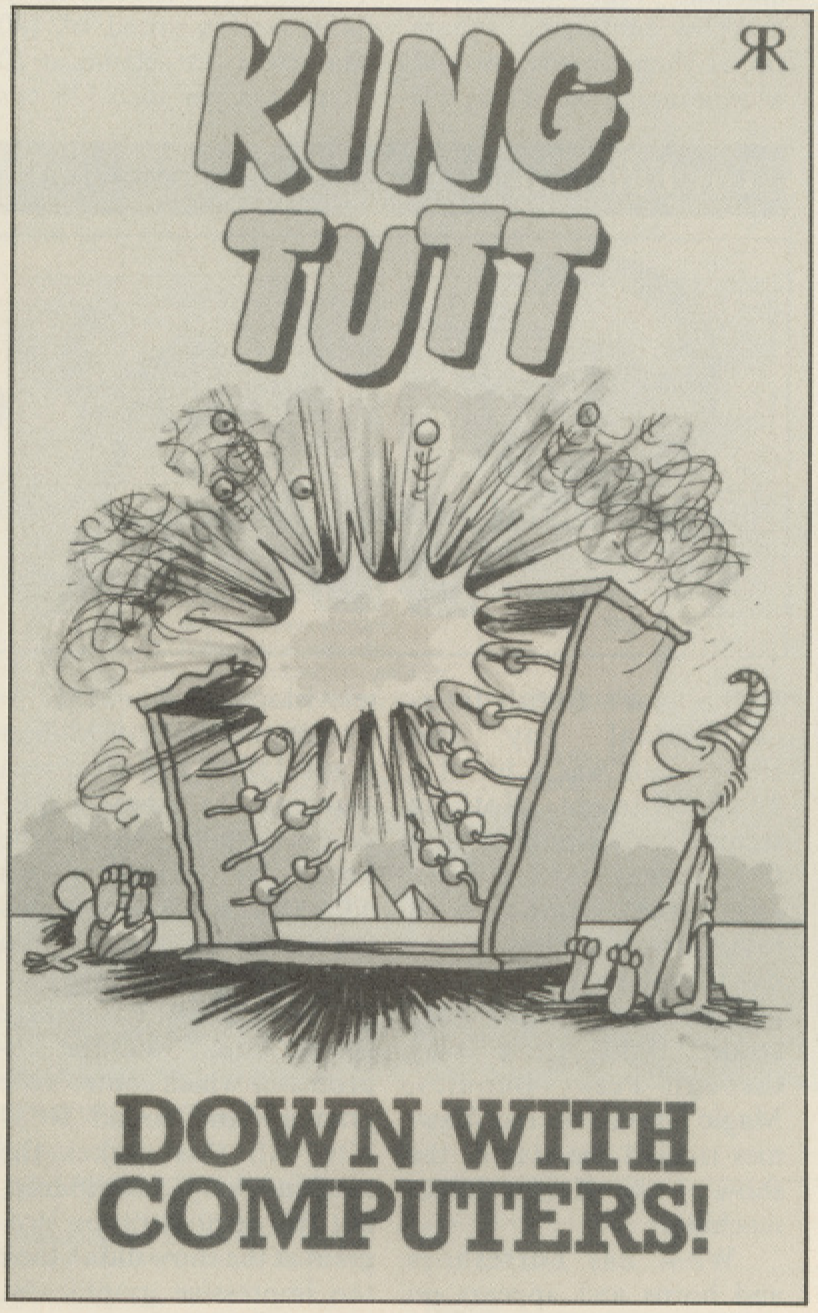
Grandslam Entertainments' latest announcement – that Liverpool Football Club have endorsed the company's next football game – is surprising, to say the least. As yet the prospective game consists of a rather uninspiring title, *Liverpool: The Computer Game*, and the vague but obvious concept that it will be a football game.

Perhaps this is sufficient for an endorsement, but as Stephen Hall, Grandslam's managing director, says, "Now we're ready to take on the challenge of producing a game that will match the enormous stature that Liverpool Football Club enjoys." I doubt if Liverpool would be pleased to endorse it if it turns out like the Peter Shilton game.

In a further burst of overconfidence, Hall continues, "The popularity of this type of product, plus what we consider the greatest sports licence yet seen in this market, means we've got a real winner on our hands."

So it would appear that all you need to do is to produce a football game and you're half way to gaining a licence to print money.

Touchline: *Grandslam Entertainments, 12-18 Paul Street, London EC2A 4JS.* ***Tel:*** *01-247 6434.*



Value Added Virus

When the Friday 13th virus struck last Januray most people threw up their hands in horror and panicked. Not so for S&S Enterprises. They quickly realised that there's money in them there ills and proceeded to produce a diagnostic disk for a 'nominal' £5 a throw.

The virus, known to its enemies as 1813 because of the number of bytes that it occupies, secretes itself on a disk and waits for Friday 13th to come around. On the assigned date is happily wipes any file that comes near it and slows down the computer's processing speed, thereby causing great confusion.

Although there was an outcry last January and the news hit the daily newspapers, only three affected sites have been drawn to the attention of S&S, which poses the question of what was everone shouting about?

Touchline: *S&S Enterprises, Weylands Court, Water Meadow, Germain Street, Chesham, Bucks HP5 1LP.* ***Tel:*** *(0494) 791900.*

Bye Bye Budget Buys?

After Code Masters announcement that its product prices were to be increased by £1 to £2.99, there has been a rush by other budget houses to deny that they will soon be following suit.

Paula Byrne (Silverbird) has confirmed that the company will maintain a £1.99 range but that releses will be fewer and further between. Other houses such as Alternative and Mastertronic are also trying to keep prices down but their launching of higher priced labels does leave the door open for them to abandon the lower price range whenever necessary.

Weird TV

One of the hits of the 1988 PC Show was the ST version of Rainbird's *Weird Dreams,* and now it's been taken up by ITV's *Motormouth,* who knows what will happen to it when it becomes available for the C64 and Amiga?

The TV game is a bit of a cheat really because the sound effects are created through a MIDI interface using an Akai sound effects box and the game itself has been reworked to run on an Atari ST Mega 2, not the sort of gear to be found in the average home.

Don't be put off too much by this information though, the game did look v-e-r-y good at the Show.

Touchline:** Rainbird Software, First Floor, 64-76 New Oxford Street, London WC1A 1PS.* ***Tel: 01-631 5373.

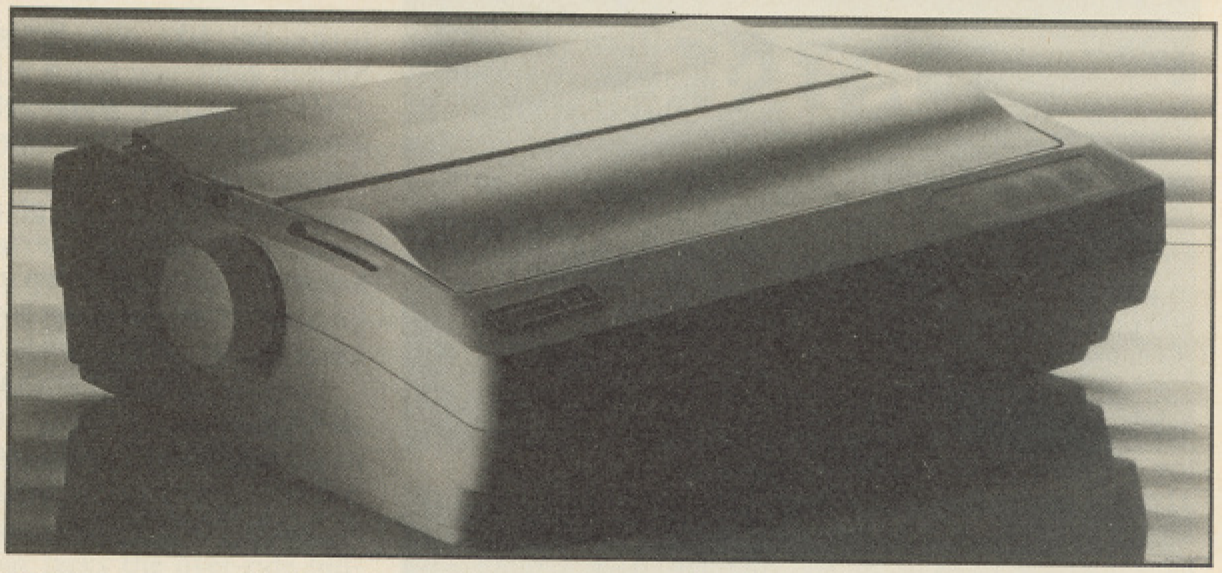
Bingo, It's Bob

Domark are releasing the computer version of BBC TV's quiz show, *Bob's Full House.* Although they can't offer Bob Monkhouse himself, don't start counting your blessings because they've included a stupid little 'acid house mouse' that breakdances its way through the game.

Up to four contestants can battle it out as they try to become the one who will go on to the Golden Bingo Game. If you want to run the risk of being 'wallied' then this is the game for you.

***Touchline:** Domark, Ferry House, 51-57 Lacy Road, Putney, London SW15 1PR.* ***Tel:** 01-780 2222.*

Cheap Mannesmann



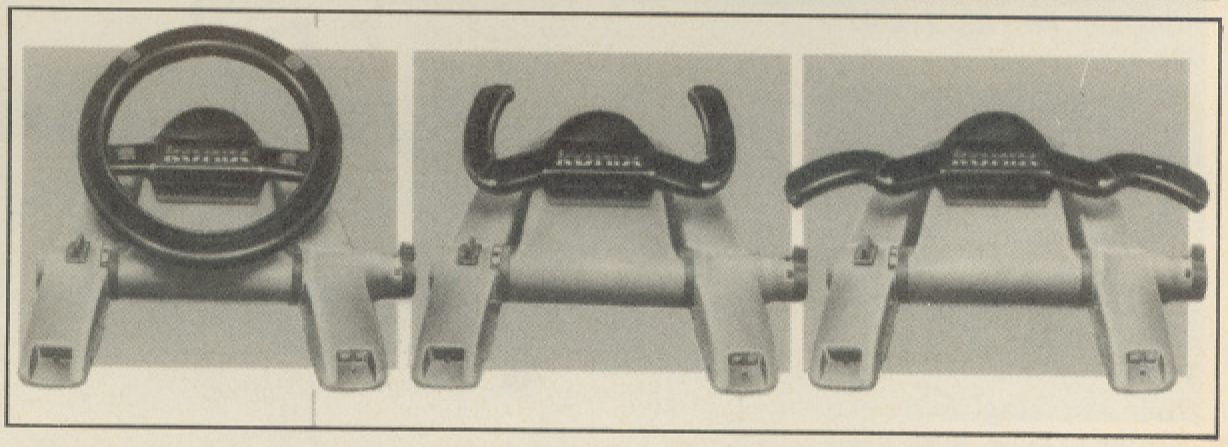
Have you noticed how companies prefer to say 'entry level price' rather than cheap or even affordable? The latest candidate is the Mannesmann Tally MT81 at £149.

This nine-pin dot matrix machine breaks with tradition by employing square rather than round pins and Mannesmann claim that this enables a better looking NLQ printout. Another feature not usually found in this price range is a paper parking facility which makes switching back and forth from sheet feed to tractor feed a lot less fiddly.

Epson and IBM compatibility and a speed of 180 characters per second at 10 characters per inch (26 cps in NLQ) should ensure that the MT 81 carves its own niche in the market or at least proves more than an empty threat.

***Touchline:** Mannesmann Tally, Molly Millar's Lane, Wokingham, Berkshire.* ***Tel:** (0734) 788711.*

Toy Fair



This year's British International Toy and Hobby Fair was a bit of a disappointment. Nothing seemed radically new and there seems to be a move away from computerised toys towards the less expensive to make ones. The more adventurous show-goer could fight their way through Perky Bunnies, Magic Shrinkles and Yawnies to find the star of the show – the Konix games machine.

What has horseshoes and horns and appears on television? The Konix Multi-System, that's what. Man, it is weird stuff! I've never seen anything like it before. The base is the horseshoe and the horns are formed by an adjustable set of handle bars (or a steering wheel if you bend them another way).

The processor is a mere 16 bit affair, and the co-processor which controls the graphics and sound is 32 bits. All this makes the machine very fast indeed, but the demonstration program at the show didn't look too impressive graphically. The program development houses are complaining because they haven't been given the full information on the machine so that could be why the graphics looked like high speed 8 bit games.

I'm sure that the Konix is capable of better things but on the evidence so far I'm unimpressed.

***Touchline:** Konix Products, 35 Rassau Industrial Estate, Ebbw Vale, Gwent NP3 5SD.* ***Tel:** (0495) 350101.*

Techno Cop

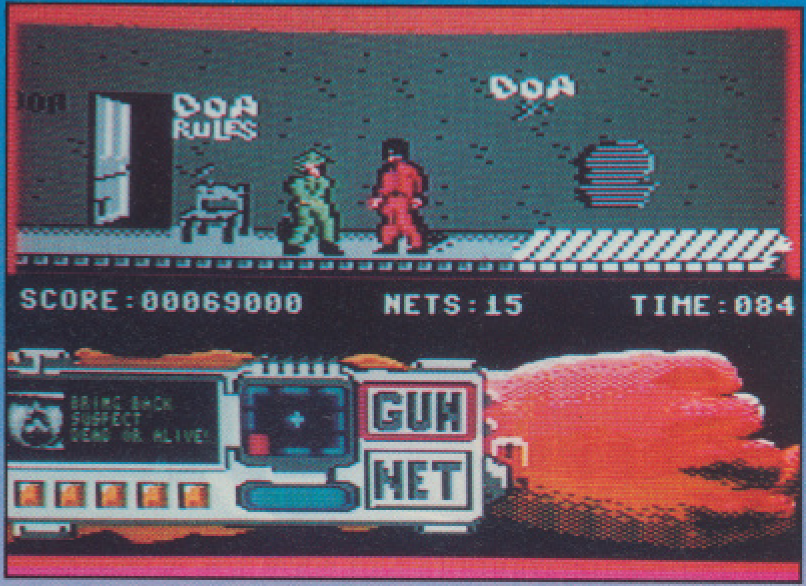
Equipped with the most powerful handgun known to mankind, and the latest high-speed pursuit vehicle, you are one of the new breed of law enforcement agents. You mission is to seek out and destroy members of the DOA (Death on Arrival) gang.

The game has two parts, the first of which is a car chase, during which you get the chance to blow every other vehicle off the road with an ever-increasing array of weaponry. Should high-powered cannons and tactical nuclear weapons prove insufficient for your needs, you can always try ramming them instead, although this increases the damage to your car (apparently exploding nukes don't even scratch the paintwork).

Once the onboard computer has informed you of your mission (rather small, difficult to read print here) you start the second part of the game, exploring deserted buildings and blowing away sundry riff-raff who come at you with whips, knives and guns. A criminal detector radar on your wrist points the way to your target, although your actual route may be more indirect as you try to find a path through the rubble and debris. As a slight variation, some of the criminals have to be brought in alive by capturing them in your net, and there are bonuses awarded for recovering stolen property. Both the car chase and this part of the game are against the clock. Succeed in your mission and you'll be promoted, but there is no real penalty for failure, only the occasional minus score for killing an innocent bystander.

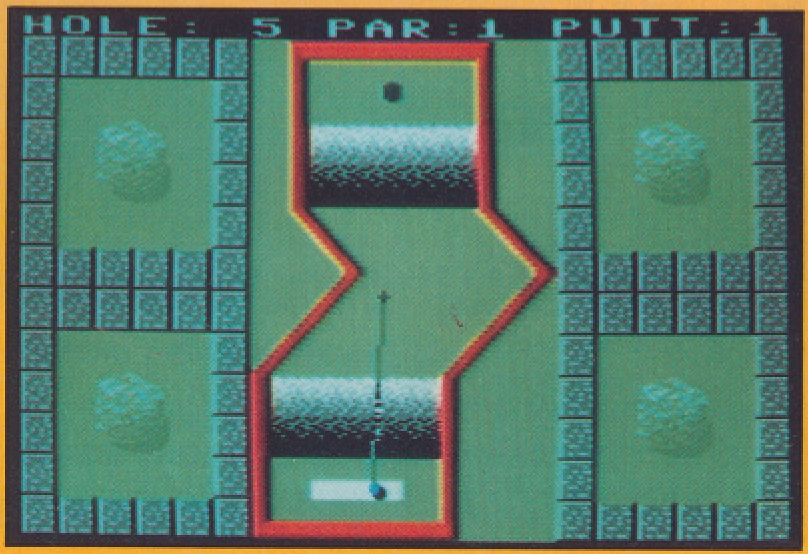
I suppose it would have been too simple to use your criminal detection radar and then nuke the building from afar, but that wouldn't be cricket, would it. There have been better race games, and better seek-and-destroy games – this hybrid falls between those two stools.

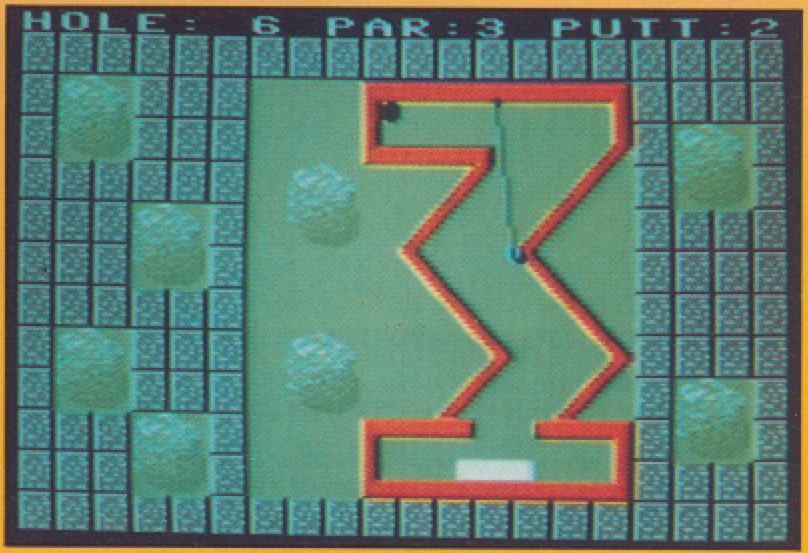
***Title:** Techno Cop. **Supplier:** Gremlin Graphics, 10 Carver St, Sheffield S1 4FS. **Tel:** 0742-753423. **Price:** £9.99 (cass).*



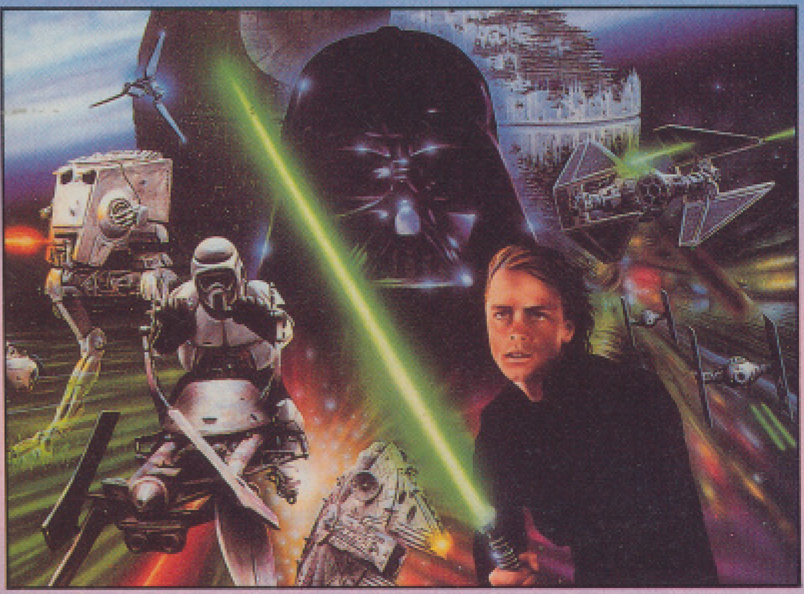


Mini-Golf





Return of the Jedi



Return of the Jedi is the third in the *Star Wars* saga to be released by Domark, and the plot (as if you didn't know) follows that of the film.

You play Luke Skywalker, trapped on the planet Edor, home of the Ewoks and crawling Emperial biker scouts. You steal one of their bikes and head for the Ewoks' village. The scouts are not at all happy about this, and set off in hot pursuit.

Careering through a forest at breakneck speed is no easy task – you must dodge the trees and Biker Scouts until you reach the safety of the Ewoks' village. Once at the Village, you control Han Solo and Chewbacca, his hairy sidekick. You must guide Chewy, and his stolen scout walker, through the forest.

Your destination is the bunker, were Han Solo is waiting to shut down the shield of the evil Deathstar. While you're playing on this level, the action switches to the Millenium Falcon speeding towards the Deathstar, and then back to the forest.

Once the bunker is reached and blown to bits by Han you then move on to the final level, the Deathstar. Here, your task is to guide the Falcon to the centre of the Deathstar and blast the reactor, destroying the Deathstar and saving the universe.

I thought Domark would have made the effort to produce a fairly decent version of the arcade game, but this is way off the mark. The sound is average, the graphics crude and blocky.

Gameplay is ruined by the control – for example you must wreastle with the joystick to control the Speederbike, as it whizzes all over the screen. I'm afraid I cannot whole-heartedly recommend this game.

Touchline:
Title: *Return of the Jedi* ***Supplier:*** *Domark, Ferry House, Lacy Road, London SW15.* ***Tel:*** *01-.780 2224.* ***Price:****£14.99*

This could have been a most enjoyable simulation, but as it is, *Mini-Golf* from Magic Bytes is let down by some dreadful presentation both in the game itself and, more especially, the instructions.

The course includes the usual mix of mini-golf features – raised plateaux, bends and corners to negotiate and tunnels to aim through. Par is indicated for each hole, although there are an alarming number of par ones, meaning that you have to be inch-perfect on the shot.

Control of the shot comes in three parts. The ball must be placed on a tee area, although why the program doesn't do that for you is beyond me. A line radiating from the ball's position then determines both the angle of the shot and, depending on how long you make the line, the power behind it. It's tempting to try and be clever and do everything with just one clever shot, but prudence soon dictates that it's better on occasion to tap the ball a few inches first, and thus gain better position for the next shot.

Up to four people can play, although there is no indication on the screen as to whose turn it is. There are supposed to be two courses, beginners, and experts although so far, I've only managed to access one of them. Perhaps this is because I've not yet recorded a good enough score to qualify, or perhaps the second course only appears on the Amiga version. The instructions, which are quite dreadful, give no help whatsoever here.

Initially fun, this game offers little in the way of any lasting challenge. You soon get to know all the best angles for any given shot, and can then repeat it more or less at will. A wasted opportunity.

Touchline:
Title: *Mini Golf.*
Supplier: *Magic Bytes.*

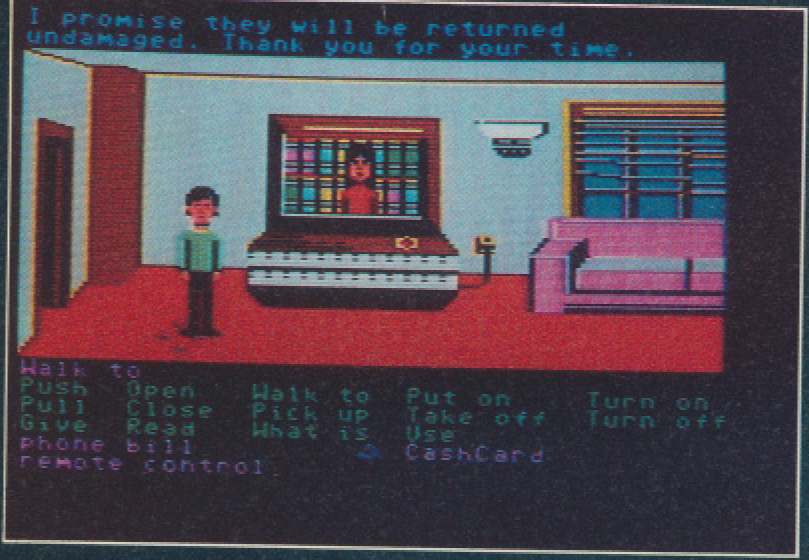
Zak McKracken

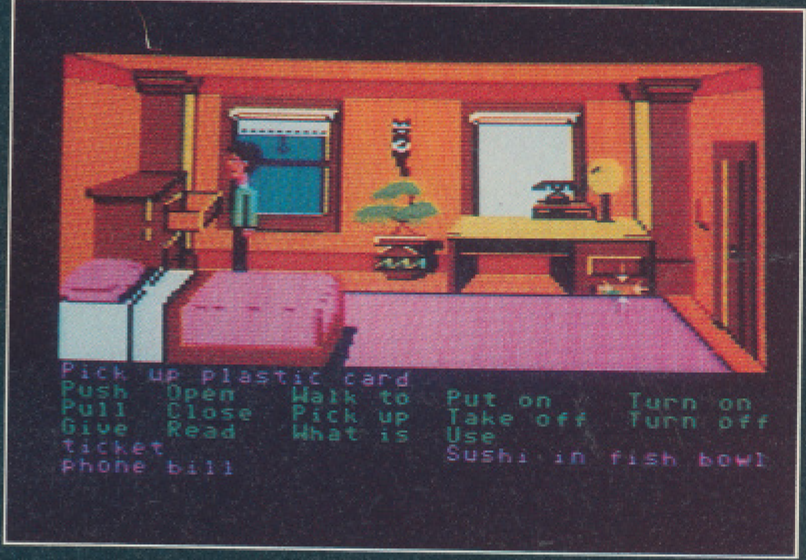
and the Alien Mindbenders

Imagine the most ridiculous plot that you've ever encountered in an adventure game and double it. I guarantee that it won't come remotely close to the storyline in *Zak McKracken and the Alien Mindbenders.* But then this game has got a head start.

Written as a spoof on *The National Enquirer* (which roughly equates with our own *Sunday Sport*), reality is to be seen only in the eyes of the gullible. For anyone who has not yet encountered one of these journals, typical stories inform you about World War II bombers on the moon, and the fact that Hitler was really a woman. These headlines alternate on a fortnightly basis with any other bit of rivetting investigative journalism on any subject whatsoever, as long as the word 'ALIEN' features prominently in the headline.

Anyway, back to the real plot. The year is 1997, and the world is getting progressively more and more stupid. Not because they insist on reading newspapers such as those listed above, but because ALIENS have taken over the telephone company, and are pumping mysterious moron rays down the phone lines. Now all you need is a couple of people who travelled to Mars in a converted van, a few two-headed squirrels, the Bermuda Triangle, visits to Atlantis and you will have destroyed the stupidity machine in no time at all.





The game involves no typing whatsoever – all the commands that you need are listed in a menu at the bottom of the screen. Although this severely limits the number of things that you can do, it does mean that you don't have to keep seaching for exactly the right combination of words all the time. In fact, most of the puzzles reduce themselves to using the right object in the right place. Lateral thinking is definitely the order of the day here, as the sort of objects you pick up are not those normally associated with adventures. A random assortment from the first few locations include a phone bill, kazoo, fish bowl and Groucho Marx nose and glasses set.

As you select different commands, Zak acts them out on screen, moving to pick things up, open cupboards and switch things on. This is a system that works well and adds quite a degree of realism (some would say the only degree) to the game. There is also a certain amount of artificial intelligence used in the program here. If, for example, you try to get object A with object B, Zak will go and pick up object B first, if he does not already own it.

One of the problems with games of this type is that it's often difficult to identify the objects from the illustrations provided, either through poor drawing or over-precise positioning of a cursor. Here, a 'what is' command lets you examine a location thoroughly, telling you which objects are part of the game, and which merely decoration.

Because of the apparent randomness of some of the puzzles, the game comes complete with a copy of 'The National Inquisitor', which provides many a subtle, and not-so-subtle hint.

Zak McKracken is a quirky sort of game that some players will love, and others thoroughly detest. If what you have read in this review strikes you as being childish in the extreme, then I would suggest that you give it a wide birth. Personally, I thought it was like a breath of fresh air, but then again, I am writing this review with a crayon from somewhere inside my padded cell.

Title: *Zak McKracken and the Alien Mindbenders.* ***Producer:*** *Lucasfilm Games. c/o Unit 2 & 3 Holford Way Holford Birmingham B6 7AX.* ***Price:*** *£14.95 (disk).*

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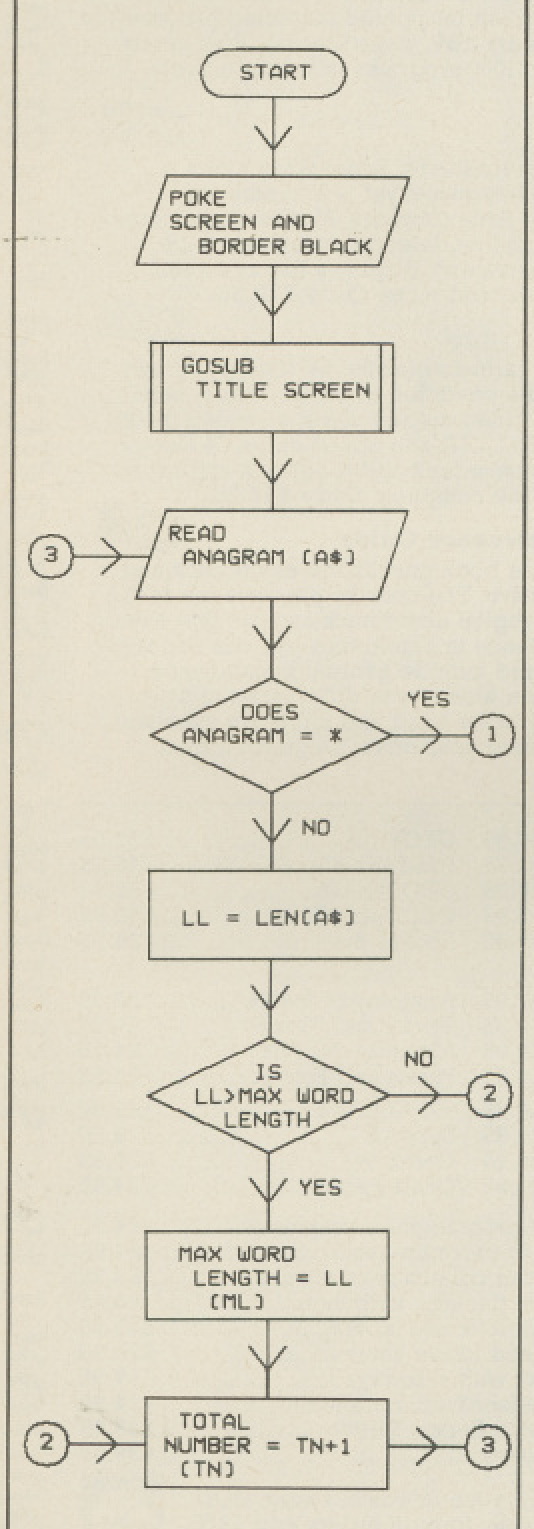
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A Flow of Ideas

How can you write an anagram game without getting mixed up?

By Norman Doyle

Flow chart 1



Before setting about the task of writing an anagram program two things are obvious: the program has to know what the word is and then the letters have to be mixed up. Since this is the most difficult part of the whole task it must be the first one tackled.

Storing the words is the easiest task because they can be stored as DATA statements but the program has to jumble them up. In the flowchart this process begins at entry point 5 which sets a counter to unity and nullifies a string, AA$.

The first step is to store the individual letters of the word in separate string variables, A$(x). By generating a random number, R%, a letter can be selected by using A$(R%) to arrange the letters in an arbitrary order. The problem is that the letters are thrown up randomly, as might be expected. For a three letter word the number sequence could be:

3 1 1 3 3 3 3 2

To let the program know which letters have already been selected, the first value selected would cause the program to remove the letter from A$(3) and store it in a string, AA$. Then A$(3) would be nullified so that the letter will not be reselected. A counter, X, is also increased to indicate that one letter has been removed from the array. The next number adds A$(1) to AA$ but the next five numbers generated have been selected before so they are ignored. When 2 occurs, the final letter is taken and this is indicated by the counter exceeding the original word's length, L.

The obvious disadvantage is that the program may take a while before AA$ is complete. The second problem is that the number sequence may result in the anagram string being identical to the original word and repeating the process would further increase the time taken for the anagramising process. Nature is a wonderful thing and the probability of an unmixed word is higher with short words but the time taken to generate a full sequence is faster. This means that the problems more or less balance themselves out and the anagramising takes approximately the same time whatever the word length.

Long and Short

Having created the engine, the size of the petrol tank has to be determined. By this I mean that the program has been devised to allow any size of word to be used but words having more than ten letters would result in an error being generated for an undimensioned array. The first part of the flowchart caters for this eventuality by measuring each word in turn and substituting the value of the longest word in the A$ array.

A secondary advantage of this module is that the program can take any number of words because the maximum length finding process also counts the total number of words as it goes through them.

The end of this module shows the importance of arrows in a flowchart. When the final block is reached the only outward flow line is the one which leads back to connection point 3.

The design of a flowchart depends on the designer. I prefer to keep the diagram linear but the flowchart of the module could connect directly to the main part of the program at point 1 if the outflow lines of the decision diamond are swapped and the following blocks on Flowchart 1 moved to the side as in Flowchart 3. This also shows the need for arrows.

PROGRAM: ANAGRAMMER

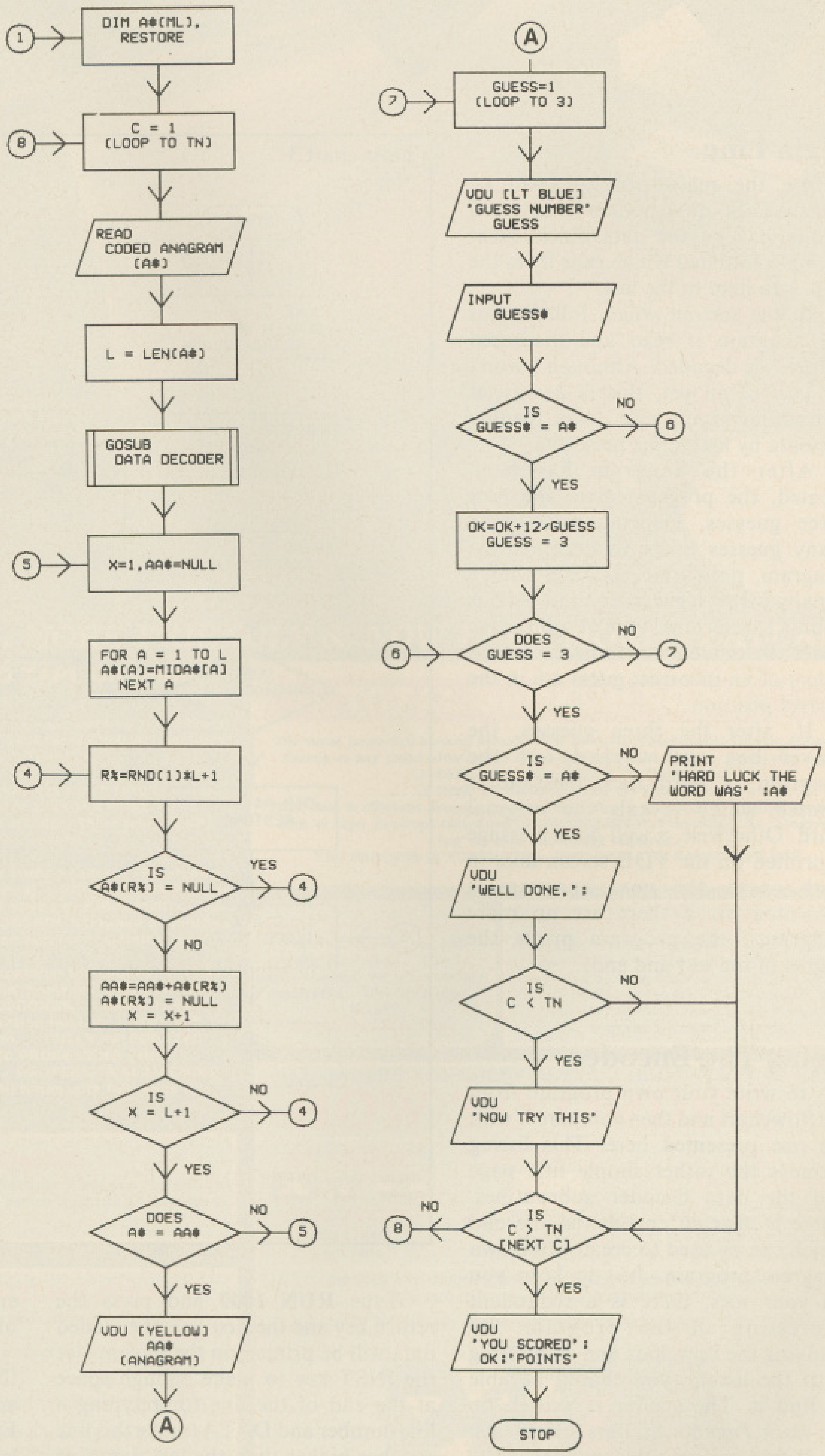
```
10 POKES3280,0:POKES3281,0
20 GOSUB300
30 READ A$:IFA$="*"THEN60
40 LL=LEN(A$):IFLL>MLTHENML=
LL
50 TN=TN+1:GOTO30
60 DIMA$(ML):RESTORE
70 FORC=1TOTN:READ A$:L=LEN(
A$):GOSUB240
80 X=1:L=LEN(A$):AA$=""
90 FORA=1TOL:A$(A)=MID$(A$,A
,1):NEXT
100 R%=RND(1)*L+1
110 IFA$(R%)<>""THENAA$=AA$+
A$(R%):A$(R%)="":X=X+1:IFX=L
+1THEN130
120 GOTO100
130 IFA$=AA$THEN80
140 PRINT"[YELLOW]"AA$"[DOWN
]"
150 FORG=1TO3
160 PRINT"[C7]GUESS NUMBER"G
;:INPUTG$
170 IFG$=A$THENOK=OK+12/G:G=
3
180 NEXT
190 IFG$<>A$THENPRINT"HARD L
UCK, THE WORD WAS ";A$"[DOWN
]":GOTO210
200 PRINT"WELL DONE,";:IFC<T
NTHENPRINT" NOW TRY THIS[DOW
N]"
210 NEXT
220 PRINT" YOU SCORED"OK"POI
NTS":END
230 REM *** DATA DECODER ***

240 AA$="":FORA=1TOL
250 B=ASC(MID$(A$,A,1))-L
260 IFB<65THENB=90-64+B
270 AA$=AA$+CHR$(B):NEXT
280 A$=AA$:RETURN
290 REM *** TITLE SCREEN ***

300 PRINT"[CLR]"SPC(15)"ANAG
RAMMER"
310 PRINT"[DOWN2]"SPC(14)"GA
RDEN CROPS[DOWN2]"
320 RETURN
330 DATA TIEW,GJFSX,JHYYVAZ,
KIJJIOMA,UTOUTY,JMMBZWWB,YOB
IHYI,CLDAMPCCTPD,*
900 REM *** DATA ENCODER ***

1000 READA$:L=LEN(A$):IFA$="
*"THEN END
1010 FORA=1TOL
1011 B=ASC(MID$(A$,A,1))+L
1012 IFB>90THENB=B-90+64
1013 AA$=AA$+CHR$(B):NEXT
1020 PRINTAA$",";:AA$="":GOT
O1000
```

Flow chart 2



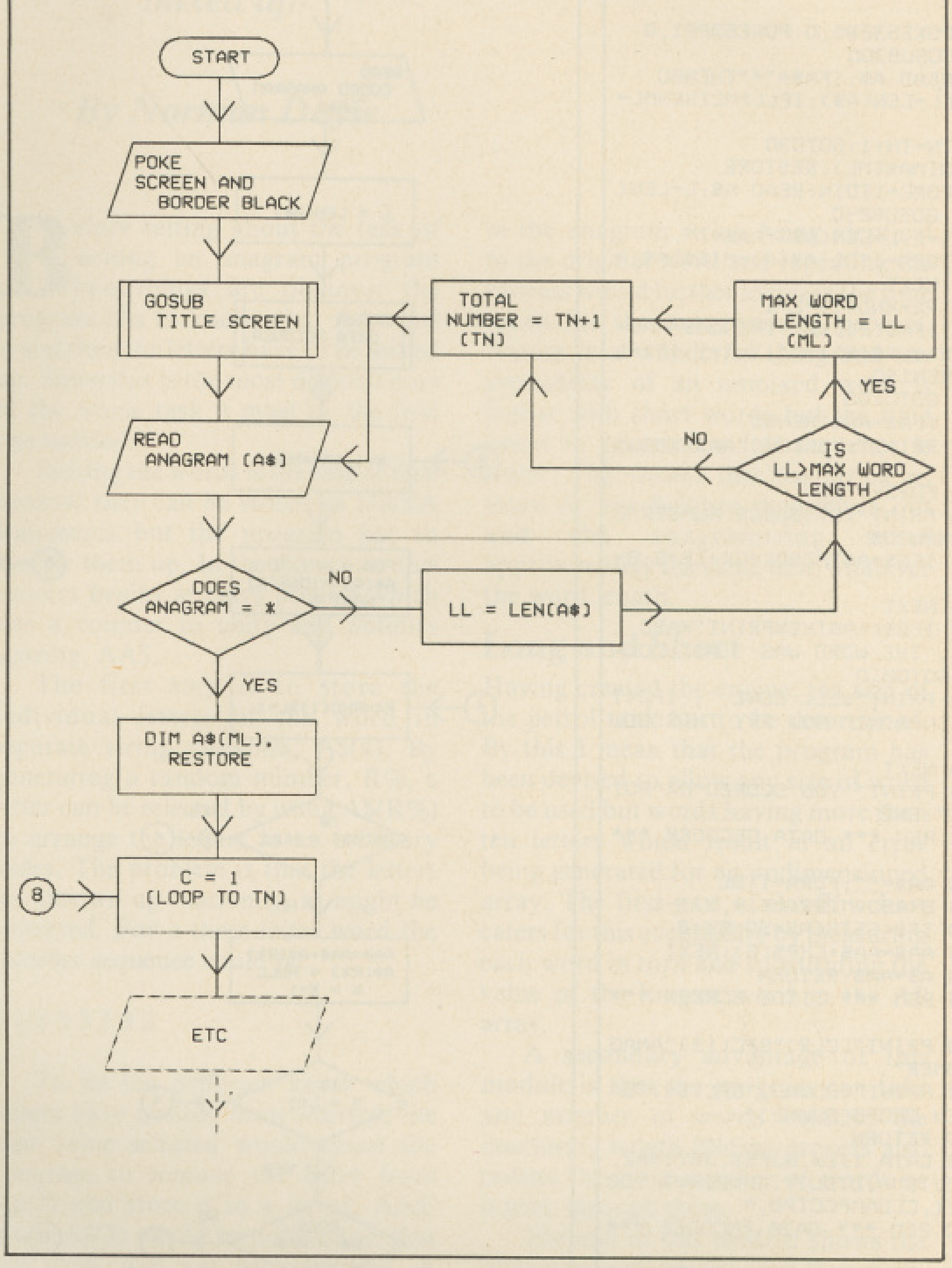
Main Line

Before the main program can be executed the data pointer is restored to the start of the data block. Next a loop is initiated which runs from the first data item to the last.

In the section which follows this the anagram is read and measured before it is decoded. Although I won't go into detail yet, this is a way of preventing prying eyes from reading the data by listing the program.

After the anagram has been created, the program gives the user three guesses. Depending on how many guesses taken to decipher the anagram, points are awarded with a penalty for each guess required. At this point a Mastermind type of subroutine could be added to indicate which letters of an incorrect guess are in the correct position.

If, after the three guesses, the player has not worked out the anagram, a *hard luck* message is printed which reveals the original word. Otherwise, a *well done* message is printed on the VDU screen and, in both cases, the next anagram is presented or, if there are no more anagrams, the program prints the results of the test and ends.



Flow chart 3

Using The Encoder

Try to write your own program from the flowchart and then compare it with the one presented here. This listing includes the rather simple title page and the data decoder subroutines. There is also an encoder at the end which can be used to create your own anagram program. Just to keep you on your toes, there is a redundant expression in the program. By studying the flowchart and comparing it to the listing, you should be able to find it. The answer is written on the *Back Page* for quitters and cheats.

Before running the encoder, write your words in the data block starting at line 300 and going as far as you like (as long as you don't go beyond line 1000). Each data line should end with an asterisk.

Type **RUN 1000** and press the return key and the first line of encoded data will be printed on the screen. Use the INST key to make enough space at the end of the line for retyping a line number and DATA (make this line number higher than the last data line in the program). Before pressing the return key, remove the comma at the end of the line. The original line with the unencoded word can now be deleted so that the next time the encoder is run it will read the next line of data.

Before pressing RETURN after the final line of data has been encoded, add an asterisk after the final comma. Enter the line and remove the original word data and the program is complete.

Whether you're interested in flowcharting or not, the program should offer food for thought for players and programmers alike.

Circus Games

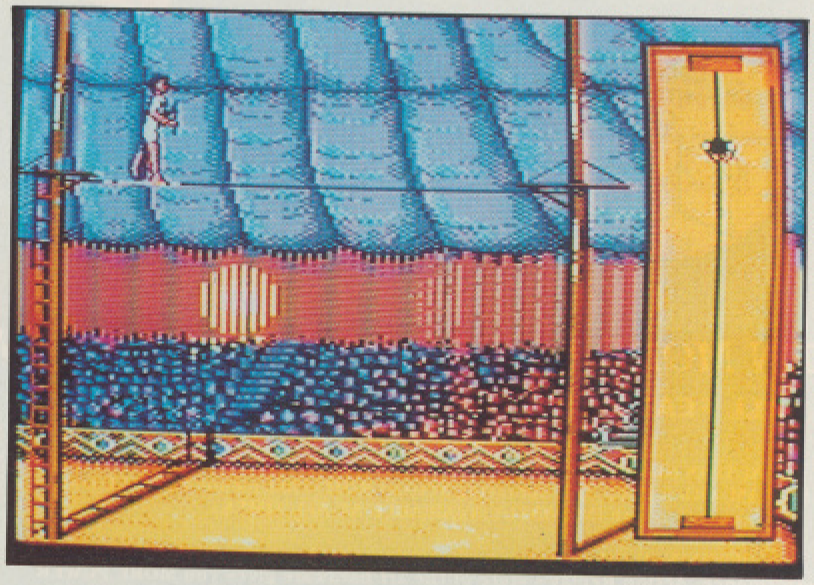


Summer Games, World games, Winter games, Ughlympics, Cosmic Games – and now *Circus Games!* This is not any old circus, as both Ringling Bros and Barnum and Bailey combine to create the greatest shown on earth, in which you'll have to train tigers, walk the tightrope, perform on the trapeze and show off your trick horse riding.

You can practise the events individually, or compete in an international competition, in which a team of judges award you marks for your performances. Walking the tightrope demands a combination of balance and courage, as you have to perform acrobatics as well. Moving across the tightrope is difficult enough as it is without having to perform acrobatics – you push the joystick up to move forward, and then left and right to keep your balance.

Pressing the fire button and pushing the joystick in the appropriate direction will perform a somersault, handstand, cartwheel or spin, but you must remember to press the fire button at the right moment when you've completed the move, otherwise you'll plummet to the ground. When you think you've mastered that, you then have to repeat the performance while riding a unicycle.

In the next event, you're a woman riding a horse around the ring, and you must perform as many acrobatic flips, handstands and spins as you can without falling off. If you're successful then you have to repeat the exercise, this time with a tougher horse.



Next, you climb up high above the ring and prepare to amaze the crowd on the trapeze, without the aid of a safety net, of course. When the event begins, you must catch hold of one trapeze and swing left and right to gain height, before judging your leap from one trapeze to the other. To really rack up the points, you may want to try a double or triple somersault while in mid-air.

The final event is only for the strong-willed, as a cage is lowered around you in the centre of the ring. You're armed with a whip and a chair, and three Bengal tigers are allowed enter the cage. To your right is a tunnel, to your left a flaming ring, and you've just two minutes to get the tigers to perform as many tricks as possible.

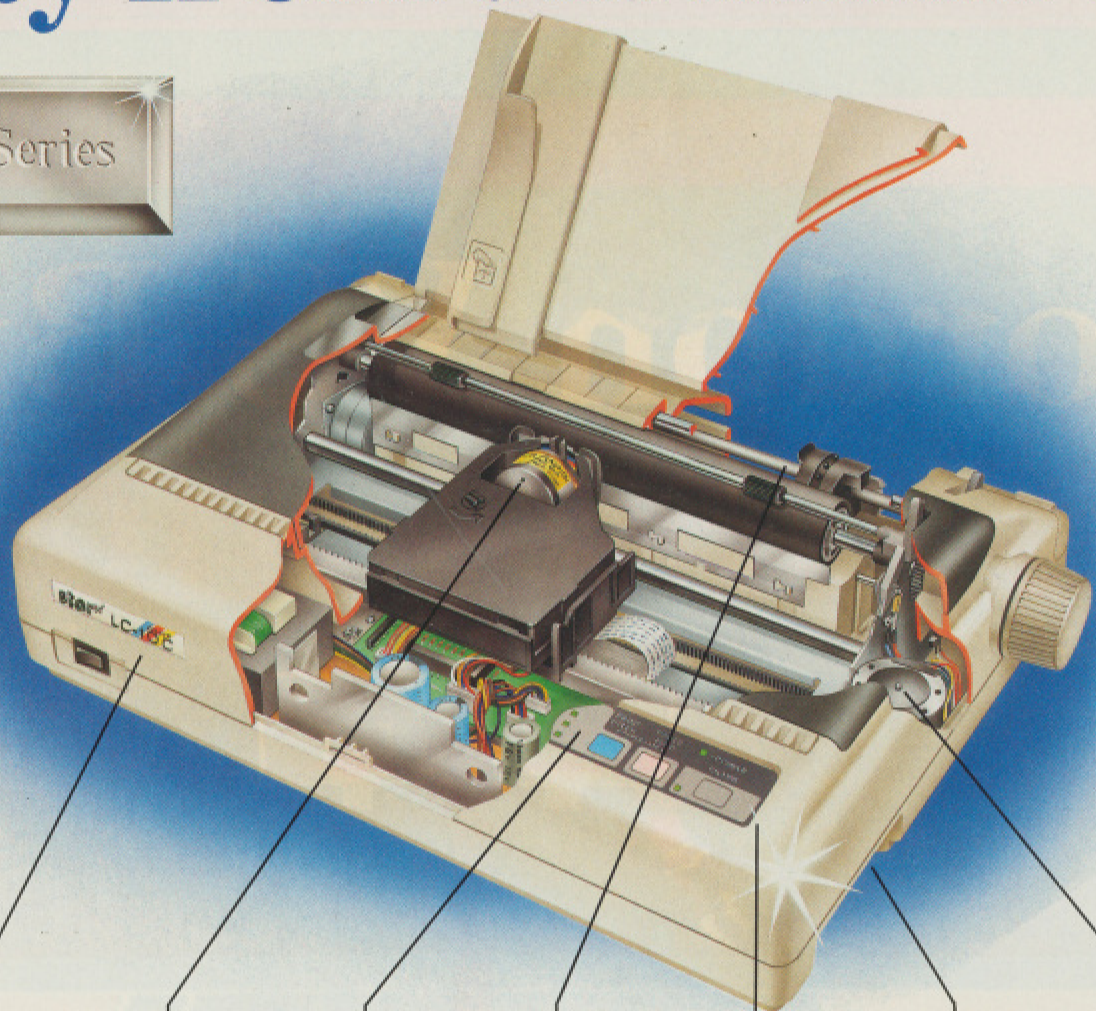
By aiming the whip at the right place and cracking it at the right time, you can steer the tigers into the obstacles, but you should avoid actually hitting the noble beasts, as this tends to annoy them. At first they just get unpleasant, but they're dangerous, and if you don't manage to calm them down by wielding the chair, they'll attack and you'll lose points as well as an arm or a leg.

All the *Circus Games* events feature some quite impressive graphics and animation, which is accompanied by appropriate circus-style music. The game is quite difficult to learn, but provides a pleasant change from the usual collection of 100 metres, high jump and ski slalom events.

Touchline:
***Title:** Circus Games.* ***Supplier:** Tynesoft, Addison Industrial Estate, Blaydon, Tyne and Wear, NE21 4TE.* ***Tel:** 091 414 4611.* ***Machine:** C64 Disk.* ***Price:** £9.95 (cass), £14.95 (disk).*

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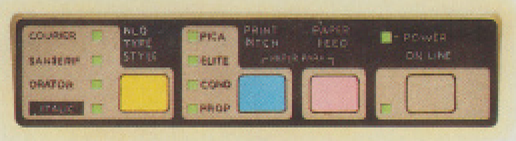


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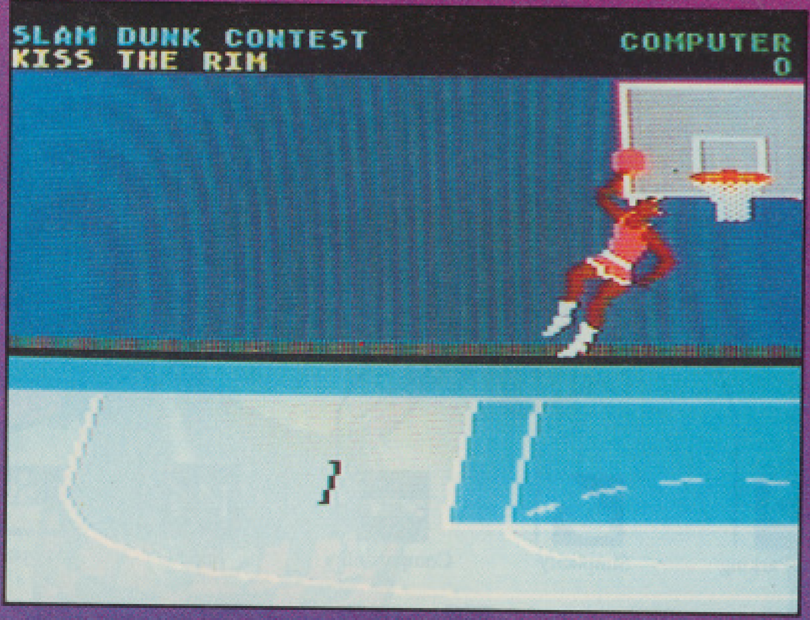
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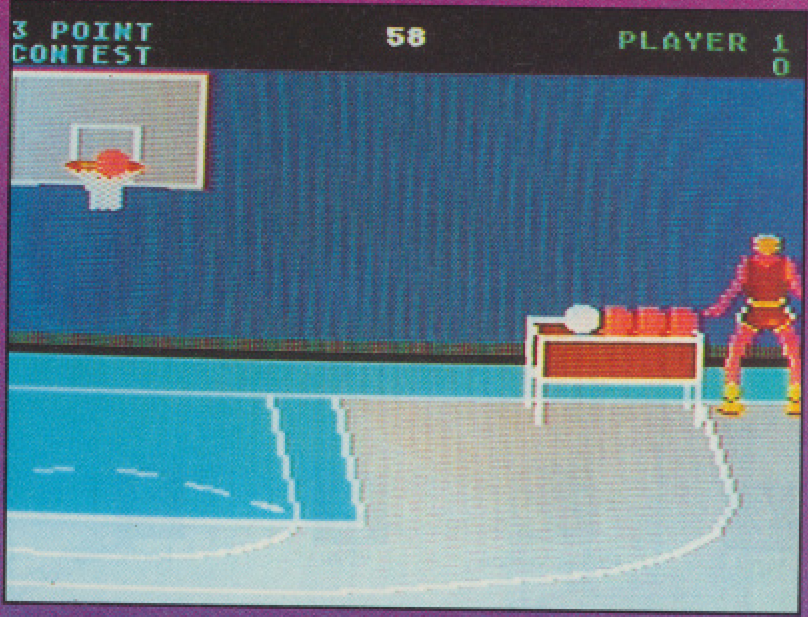
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Jordon VS Bird





In basketball, the greatest thrill is when a forward and defender go one-on-one. To celebrate this, Electronic Arts has created a series of one-on-one tournaments designed to see who is the greatest. Will it be Larry 'the shooter' Bird or Michael 'the slammer' Jordon?

The first tournament is a straight one-on-one basketball contest in which you play either Jordon or Bird in four quarters of basketball. The game centres around a single basket, as each player takes it in turn to attack and defend, while you try and outscore your opponent. This is just the first option on the game list: along with a first to 11 and 15 points options, you can also opt to tackle Bird and Jordon in their specialist competitions.

Larry Bird's speciality is getting those long three pointer shots from outside the shooting zone, and has devised a shooting contest in which you have 60 seconds to score as many points as possible by collecting balls from five containers spread around the basket. In a test of speed and accuracy, it's the number of points that count, so you have to either shoot quickly or accurately, but to mimic Bird you have to do both.

By far the best part of the game is Micheal 'Air' Jordon's slam dunk tournament, in which you take on the computer or up to three human opponents in a test of skill and style. You get a choice of ten different slam dunks to try in a warm-up session, before taking on the master. These include the energetic two-hand hammer and kiss-the-rim, the acrobatic twister and windmill, and even the patriotic Statue of Liberty.

Each moves starts with a leap in the air from a marked line of the court, and hopefully ends with the ball being decisively slammed into the net. In slam dunking, getting the ball into the net isn't enough – you need style as well, so you can make things difficult for yourself by adding in extra twists and turns. If you make the shot as well, then you're in Jordon's class, if not you should keep to the basics.

There's even a panel of five judges to reward your efforts, with the aim being to reach the perfect 50. In the contest itself, it's the best accumulated score after three dunks, so you have to make every one count, and it's up to you whether you go for certain safe jumps or risk piling on the style.

Then it's back to the one-on-one-contest with your new-found skills, and another attempt to prove whether Jordon or Bird is the player of the decade. Obviously, this will have more appeal on the other side of the pond, but there are a growing number of basketball fans in Britain who will find this amusing as well.

Touchline:

Title: *Jordon VS Bird.* ***Supplier:*** *Electronic Arts, 11-49 Station Road, Langley, NR Slough, Berks., SL3 8YN.* ***Tel:*** *0753 49442.* ***Machine:*** *C64 disk.* ***Price:*** *£14.95 (disk).*

Super Snapshot

Just what is so super about this latest cartridge from the good old US of A?

By S Garton

When the C64 computer was first launched, everyone thought the fact that it had a cartridge port was a great idea. It meant that you could plug in a wordprocessor, game or whatever and have it instantly available. Unfortunately, no one seemed interested in using the cartridge port, and only a few ever appeared, including a number of poor quality games under the Commodore label. Just as everyone thought that the C64 was starting to run its last race and slowly sink into oblivion, the utility manufacturers inundated users with a variety of "utility" cartridges.

Now, a couple of years on, we've had the Finals, the Experts, the Freeze Frames and the Action Replays. All have gone through various changes and updates, some simply through software available on disk. Others have taken on a whole new identity, and have had their own custom chips designed. After all of this, Financial Systems Software still think there is room for yet another cartridge – Super Snapshot.

If you've ever read any of the American computer magazines, then the name Snapshot will not be new to you. As with the UK cartridges, it has been through various design/software changes and has proved very popular. A number of American magazines even credit the cartridge on their contents pages, because they use it to freeze pictures for inclusion in the magazine.

So what does the cartridge do? Does it offer any new features? Is it any better than the cartridges on sale at the moment?

What's on offer

The Super Snapshot cartridge has some software on the cartridge, and some supplied on disk. Super Snapshot is unlike the Expert cartridge from Trilogic, as you aren't required to load in software before you can use it – many functions are available as soon as it is plugged in.
Facilities offered by the cartridge are:

Disk Copiers (partly disk-based)
File Copier
Program Freezer
DOS Support
Programmable Function Keys
Turbo Dos
Boot Sector Support
Screen Copy
Extended Life
Sprite Enable/Disable
Machine Code Monitor
Disk Editor
Disk Memory Editor
Sprite Examiner

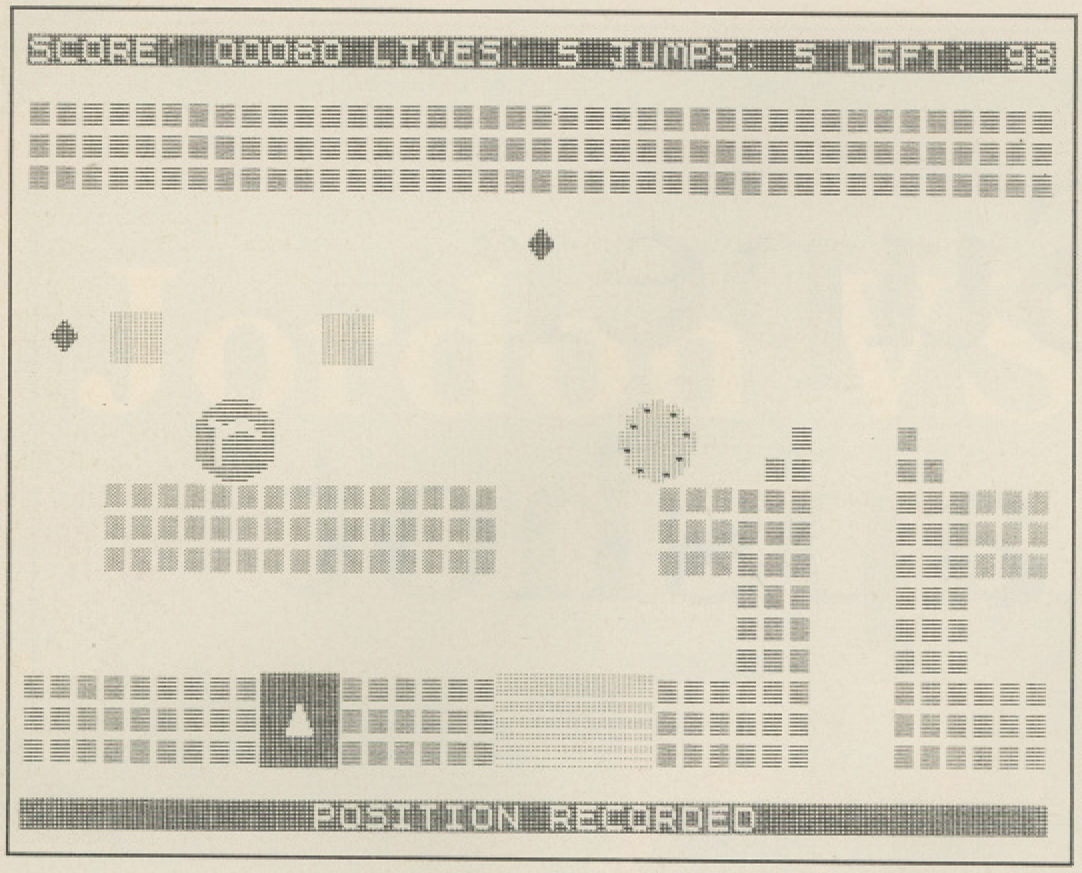
As you can see, the list is extremely exhaustive and has just about everything that you'd require when using your C64. The system disk that comes with the cartridge contains:

Boot Sector Maker
TURBO*25 convertor
TURBO*25 utilities
Sprite Editor
Extended Basic
Disk copiers/program parameters

To Copy or Not to Copy

It seems almost every cartridge that appears on the market at the moment is designed to help you copy programs. Well, Super Snapshot is no exception. It's important to remember that all of these cartridges are designed so that users can make back-up copies of THEIR OWN software.

Equally important, you should be able to make back-up copies of your programs, just in case something goes



wrong with the original. In fact most "professional" software tells you to make a back-up copy of the program before starting to use it.

But, and it's a big but, you shouldn't use copiers or cartridges to make copies of software that you don't own. If you pirate software in this way, then you're only harming the software industry and pushing prices up. If you do copy a friend's software and you're caught, then you deserve everything that's coming your way!

I won't dwell on the freeze/copy side of this cartridge for too long. What I will say is that it does freeze some programs (make a copy), but not all, and the disk nibbler and parameter copier are among the best that I have come across – but again will not copy everything. As yet I've never found a cartridge or copier that would work with everything that I tried.

The file copier facility is a welcome one, as it certainly speeds up transfer of programs from one disk to another. I already own many disk-based file copiers, but having one on cartridge saves a lot of time hunting for the correct disk and then loading the program.

Now For The Rest

Most of the other facilities of the Super Snapshot system are command/menu based.

The monitor, as you can see from the table, offers all of the commands that you would usually expect, plus a few extra. The monitor is not memory resident, which means that you can examine any part of the computer's memory with ease. The hex/decimal conversions and the assemble options are very welcome. Most programmers will tell you that these are essential requirements, and it's surprising just how many monitors don't have them.

Should you ever require a copy of your computer screen, then you'll find the screen copy mode a welcome addition. Many cartridges offer the facility of saving out screens as a Koala Pad file – Snapshot not only offers this option but also, depending on the mode the screen is in, allows you to save files that can be loaded into Doodle. Once you've loaded your screen into either of these graphics packages, you can alter them, print them out, etc.

Not only does Snapshot allow you to save out screen contents but it also provides you with the facility of dumping the screen to a printer. Both text and graphics dumps are supported. If you produce a graphics dump, this can be in any one of three sizes, plus you have the unusual facility of being able to dump any sprites on the screen.

Should you own a C128, then you have the extra facility of switching the computer into the 2MHz mode and using this to print out a lot faster. But remember the cartridge does NOT work in C128 mode.

One of three printers can be used to produce your dumps: 1525, 1526 and Epson. The 801 and 802 printers are more common in the UK than the 15 series. The dump does work with these printers, as they are compatible with the 1525 and 1526. Owners of non-Commodore printers should note that the printer should be connected to the serial port – not the user port.

So that you can examine the results of the screen dump option, some samples have been included with this article.

Monitor Commands

A	Assemble
BR	Set break vector
C	Compare
D	Disassemble
F	Fill memory
G	Go
H	Hunt
I	Interpret memory
IO	Display IO registers
L	Load a file
M	Memory display
O	Output to a device
R	Display registers
S	Save file
SP	Disable sprite collisions
SPB	Disable sprite/background collisions
SPS	Disable sprite/sprite collisions
SPR	Re-enable all sprites
T	Transfer memory
X	Exit the way monitor entered
XB	Exit to Basic
XM	Exit to sub-system menu
:	Modify memory
;	Modify register
,	Disassembly modify
#	Convert hex to Decimal
#+	Convert decimal to Hex
+	Used to enter decimal
$	Display disk directory
*	Modify I/O registers
@	Read disk error channel
@#n	Set disk device number to n

It's important to note that not all game/program screens can be dumped to a printer, especially if the program has a split screen. Many games use split screens to give the impression of moving backgrounds, or to change screen modes at different positions of the screen. Should you enter the screen dump section of the cartridge while using a program that does this you'll only see a small part of the program. There is no way to successfully dump a program of this type.

Disk Editing

The disk and drive memory editors mentioned earlier are really just extensions of the cartridge's powerful monitor. Commands exist that allow you to read an area of the disk into a specified area of the computer's memory where you can them examine it, alter it, and then save it back out again. This is not the most elegant form of disk editor that I have come across, but it does work and is good for making quick alterations.

The drive monitor allows you to access the memory in the disk rather than the one in the computer. A *8 command in the monitor tells the computer that you are now working on drive memory rather than in the computer. All display/modify commands that can be used in the monitor can now be used to examine/modify the drive memory.

Playing with sprites

If, like me, you're completely hopeless at art, then no doubt your sprites always look like something that crawls out of a coffee cup after it has been left on the windowsill for one month too many. The sprite monitor will allow you to examine your favourite games for sprites and save them out to disk, where you can modify them and then include them in your own program – don't forget that you can't pinch sprites from other people and use them commercially!!

Once you've saved your sprites to disk you can use the sprite editor to alter them to your heart's content – you could even use it to design new sprites for games and then use the monitor section of the cartridge to place the new sprites into your game.

Also on Disk

The so-called Basic extension provided on the disk is really quite laughable. The commands all work and are extremely handy to have around, but the list of commands available can hardly be called extensive. To be fair though, the commands that are available are the ones that you would probably use 95% of the time in any Basic extension, and the extras would only be used occasionally. If you are only interested in "toolkit"-type commands, then everything that you'll need is there.

Putting the boot in

If you've ever used a C128, then you'll probably know that it has an autoboot facility. This simply means that when the machine/disk drive are turned on then the computer looks to see if a boot track has been written. If a boot track is found, then the appropriate program is loaded and run.

With Snapshot, C64 owners can use this facility. A separate program supplied on the system disk is used to set up the program that you wish to autoboot, and the boot sector. The cartridge will check any disk in the drive at power up to see if the boot sector has been set-up and if it has, load in the relevant program.

My attempts at making a program autoboot showed that only a Basic program can be specified as the auto start program, there is no provision for entering a start address for a machine code file. This is no problem though, as the program that autostarts could be a simple two line Basic loader for the machine code program such as:

```
10 IF A=0 THEN A=1 : LOAD "M/
C",8,1
20 SYS start-address
```

When you power up the computer plugged in, you are offered a menu offering some of the cartridges facilities, some of these allowing you to exit to Basic with or without an autoboot occurring. Should you not choose anything, the computer will drop into Basic and perform an autoboot.

Another nice touch is the addition of the keyword BOOT to the Basic vocabulary. Now if you change disks in the drive you can type BOOT, and as long as you have the boot sector set-up, then the program will autoboot, you could set up a boot sector on all your disks to give you a menu of the programs available.

Warp Factor 25!!

Even though the cartridge offers turbo loading and saving facilities (loading up to 15 times faster, saving up to seven times faster), the Snapshot Systems disk has a couple of programs that allow you to speed up loading by up to 25 times faster. TURBO * 25 convertor allows you to change any snapshot saved file into a special new format.

Unlike the TURBO load facilities of the cartridge TURBO*25 files can only be loaded on a 1541 compatible drive, the turbo DOS of the cartridge works with all commodore drives.

The second file gives you the facility of setting up a fast loader on to your disk that can be used with WARP*25 files. Once installed on your disk, this loader will list all files on the screen, and you simply have to move the cursor to the file you require and press return to load it. The loader will work with normal files but the performance is nowhere near as good.

Since TURBO*25 files are in a special format, normal DOS commands won't work on them. The same program that allows you to produce a loader therefore gives you the facility to delete and rename WARP*25 files.

Once you've converted a couple of files to WARP*25, you'll wonder how you ever managed without it – the increase in speed is amazing. Some programs even load faster than with my Dolphin DOS!

Is it worth having?

To be honest, I wasn't looking forward to looking at yet another cartridge, I've seen them all and I thought that there could be nothing new. Well I was right and I was wrong.

Super Snapshot does not offer anything that is not available on other cartridges – what it does do is offer a slightly different collection of routines from the others. I personally liked the facilities Super Snapshot gave me, and will no doubt use it regularly.

If you're thinking of purchasing a cartridge I suggest that you look carefully at what each one offers and choose the one with facilities that best suits your needs.

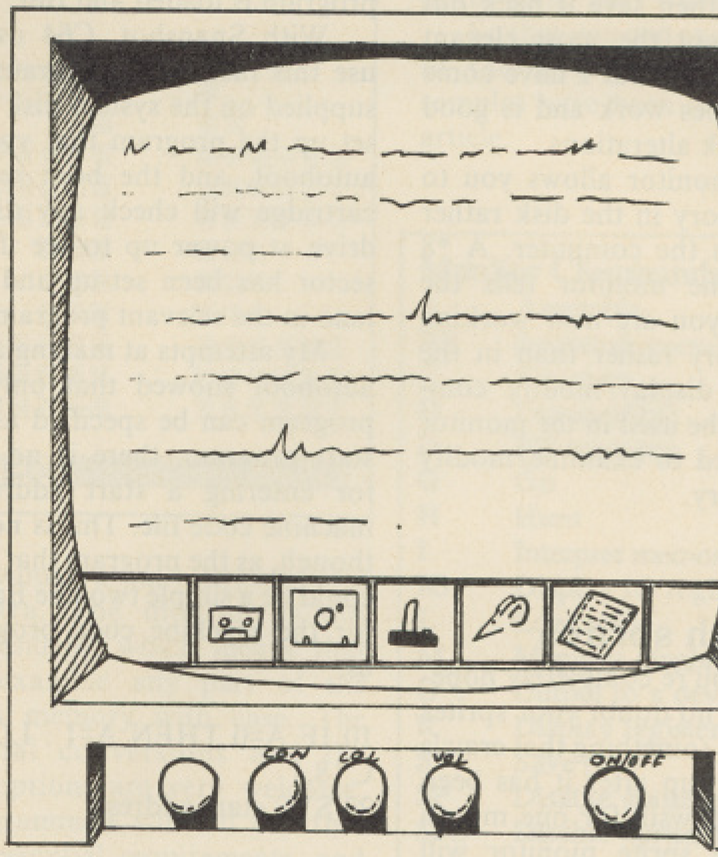
I really only have one gripe about Super Snapshot, and that is that there isn't a switch to turn it off. I use a C128 and when the cartridge is in the cartridge port it automatically goes into C64 mode on power-up. If there was a switch that turned the cartridge off, then I may never need to remove Super Snapshot from my machine.

Touchline:
Product: *Super Snapshot* ***Supplier:*** *Financial Systems Software, 2nd Floor, Anbrian House, St Mary's Street, Worcester, WR1 1HA.* ***Tel:*** *(0905) 611463* ***Price:*** *£39.95.*

Icon 64

Improve the presentation and ease of use of your programs with this simple utility

By M Medhurst



I don't know about you, but programs with with a long list of menu options that require the pressing of a number to select the correct one drive me up the wall. It would be so much easier and more attractive if you were presented with a series of pictures for the relevant choices, and used the joystick to point at the option you wanted. Hence the birth of Icon 64.

The program is designed to be incorporated in programs that you write yourselves – as a stand-alone utility it doesn't do very much. It's totally up to you to produce the program that uses Icon 64.

What the program does is display a series of eight icons at the bottom of the C64 monitor screen. A joystick in port 2 is used to move an arrow to the icon you want to select. If you press the fire-button while the pointer is over an icon, the number of the icon is returned in a memory location.

You can check which icon has been clicked on, and cause your program to take the appropriate action. For example, clicking on an icon of a printer could print your current text in a wordprocessor. Clicking on a disk could cause a new display with various icons representing various disk options – the choice is yours.

Icon64 is a machine code routine that resides at memory location 2049 ($0801). The observant among you will realise that this is where your Basic programs normally live. For this reason, Icon64 once RUN will move the start of Basic to 3072 ($0C00).

The icons used by this routine are quite simply sprites. Sprite design is, of course, totally up to you. The eight sprites that are used by Icon 64 should be stored from memory location 2432 ($0980) to 2943 ($0B7F). You could have a number of sprites in memory at different locations, and use either a small Basic or machine code routine to move the sprites that are to be displayed into the addresses mentioned above.

Memory locations used

The following values should be poked to set up colours to suit:

POKE 2141, ICON colour
POKE 2190, HI-LIGHT colour

SYS 2089 will initialise Icon64
SYS 2120 turn on icons
SYS 2151 turn off icons

The choice of icon is left in the following locations:

PEEK (251) = Fire button pressed 1=yes 0=no
PEEK (252) = ICON under pointer 1-7 0=none
PEEK (253) = last icon selected 1-7

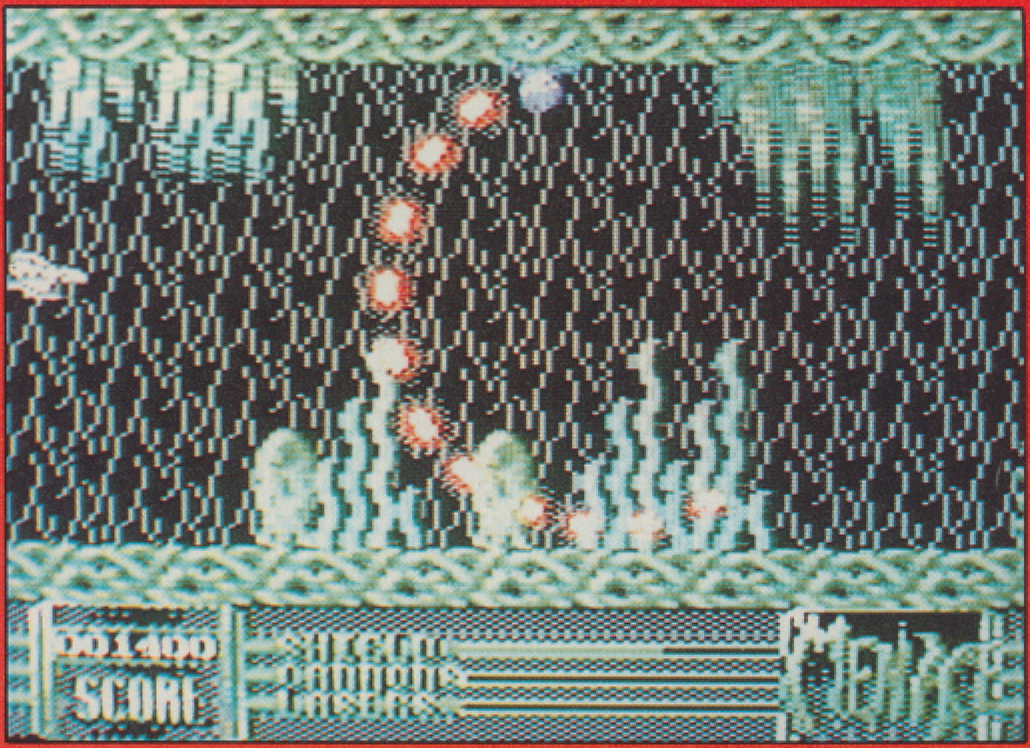
As mentioned earlier the sprite data is stored from 2432 to 2943. Sprite 0 is the pointer.

Should you wish to see the program in action, I've provided a small demo. This places some icons on the screen, and tells you which one you have selected. Use a sprite editor to examine the sprites in the demo if you want to see how they have been designed.

Important Note

Because Icon64 re-directs the C64 interrupts, you should disable the routine with SYS 2151 before any disk activity. You can, of course, re-enable Icon64 once disk activity has finished.

'MENACE'



Your mission, should you choose to accept it, is to destroy the planet Draconia. Apparently it's an unnatural planet that was formed over the centuries by six of the meanest and toughest rulers that have ever existed. These leaders, having been exiled from their own galaxies, have ravaged and plundered space, and used the worlds they have destroyed, and the creatures they have created, to build their planet of fear and death.

Your mission is to embark on what could be a suicide mission, as it has been calculated that a single craft may get past the planet's defences, where a fleet would be easily detectable and destroyed. Unluckily, you got chosen for the mission, which explains why you begin the game inside the mouth of a giant space slug, which now opens its mouth to let you out undetected at the start of the first level.

In a game that owes far too much to games like *Nemesis* and *Salamander*, you must then pilot your craft through the pretty but repetitive scrolling landscapes, destroying all that comes before you. You'd imagine that a single fighter wouldn't stand a chance against six levels of killing machines that were designed and built by the six nastiest villains in the galaxy, but don't worry, the authors have included a *Nemesis/Salamander*-style matter converter weapon that allows you to convert alien debris into new weapons. Naturally, you only get the chance to collect this debris when you destroy an entire wave, but when you do, it offers you the chance to save it up and then cash it in for bonus points or new weapons.

These weapons begin with short-range cannons that can be rearmed by future enhancements, lasers for long-range combat, speed-up icons to get you in and out of trouble up to seven times faster than you could before, a high energy but temporary force field, a force field top up, and up to two outriders that are attached to your ship, follow your every move and fire cannons that can get you out of a tight squeeze in an emergency.

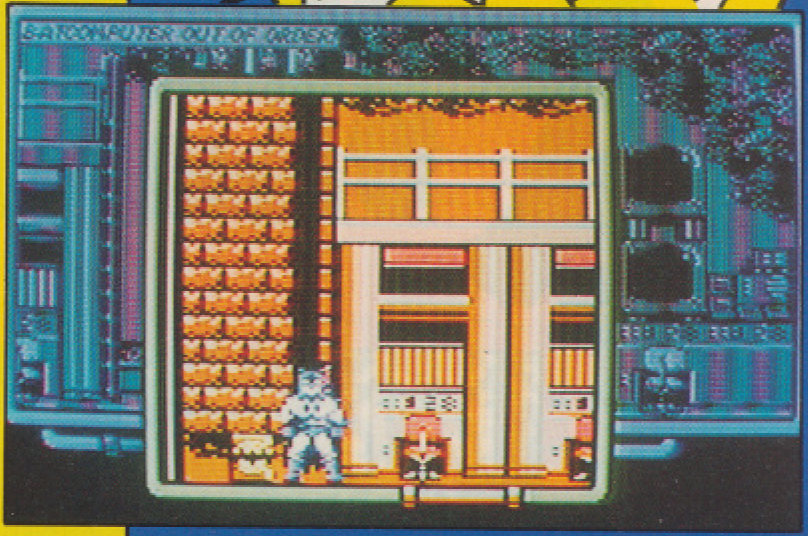
At the end of each level is a super alien or guardian that will pummel you with firepower until you hit its vulnerable spot and progress to the next level.

Menace was a smash hit when it appeared on the Amiga, probably because it looked stunning and the gameplay may still be novel, but when it's converted to the C64 not only do the graphics suffer, but so does the gameplay, as we have seen time and time again. Isn't it time for a new original arcade game, or is that too much to ask?

Touchline:
Title: *Menace.* ***Supplier:*** *Psygnosis Ltd., Port of Liverpool Building, Pier Head, Liverpool, L3 1BY.* ***Tel:*** *051-207 0825.* ***Machine:*** *C64* ***Price:*** *£12.99 (disk), £9.99 (cass).*

Batman – The Caped Crusader





This is in fact the second *Batman* game that Ocean has released, the first being a 3D isometric game released four years ago when 3D isometric games were all the rage, and Ocean was following trends. These days though, Ocean is flushed with success, and has a wealth of game-creating talent. *Batman* is just the latest in a series of hits from the revitalised software house that includes *Robocop* and *Operation Wolf*. It's hard to believe that the same company produced the dreadful *Knight Rider* and *Street Hawk*.

This time, Ocean has opted for a comic-strip-style approach, and a game that contains not one but two Batadventures, in which our hero must first foil the fiendish plans of the Penguin before tackling the Joker – two arch villians for the price of one! The game begins as Batman slides down the Batpole into the Batcave. Unfortunately, the Batcave is in a bit of a Batstate as the Batcomputer is out of operation, so he must find the Battools to fix it.

Objects such as the Battools appear on the screen in Batboxes that can be collected by pressing the fire button. This produces one of the game's best graphics effects, because instead of just telling you that you've found the battools, a batsymbol fills the screen and includes the icon representing the object, as well as a description of it. These objects are then stored in your utility belt, which can hold 12 objects that are selected and used in a separate screen that also displays Batman's energy status and the percentage of the game you've completed. Live long enough to reach 100%, and the world will be a safer place.

The rooms and corridors of buildings including the Batcave are displayed on the screen in comic-style frames that are overlayed when you move into the next frame. The old frame turns blue so as not to create a messy screen, and the effect is remarkable. Comic-style text also appears, but this is more than just the 'Meanwhile, back at the Batcave' you would expect. In fact they're clues to the problems that you have to solve next. However, most people will find these clues so obvious that they'll probably concentrate on the action, as most of the thinking is done for you. For example, when you approach a door the message 'Take your pick' appears, leaving you in no doubt that your lockpick is the way in.

Your first task is to foil the Penguin, who has just been released from jail and has set up an umbrella factory near his Gotham City mansion. Of course, this is just a front for his latest evil plan to take over the world using an army of robotic penguins. Before you can tackle the Penguin, you have to find his hideout, while avoiding the almost constant attack from gun-touting thugs and other curious creatures. These can be despatched with punches and kicks, or with weapons you can collect on the way, such as a grenade or Batarang.

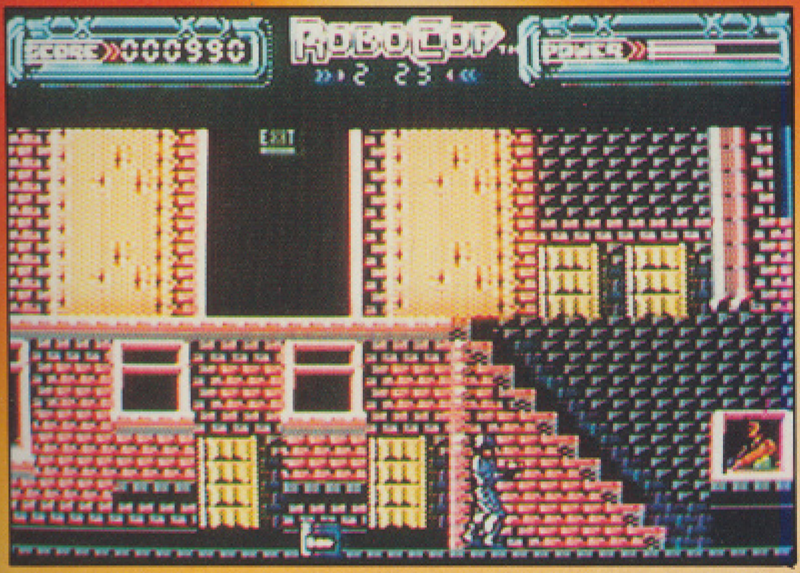
Eventually, you will discover the Penguin's lair by climbing up the side of buildings (remember not to try this at home, children), and fighting on rooftops, where you will have to slug it out with mechanised Penguins before tracking down the villian himself. Before you can start the celebrations, you discover that while you were out defeating the Penguin, Robin was kidnapped! The only clue is a playing card, which of course is the Joker, and the start of a second adventure.

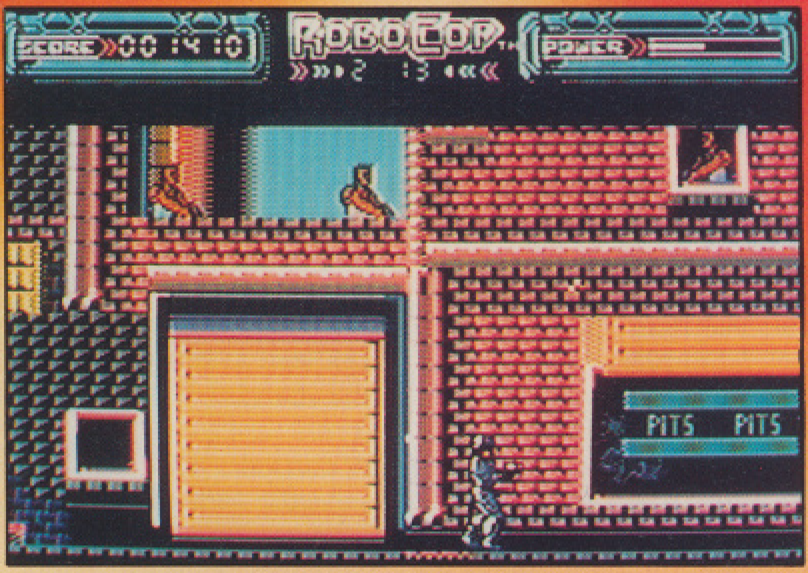
Batman – The Caped Crusader is the game that Batfans have been wating for, and the good news is that Ocean is planning *Batman – the movie* for later this year. So see you then Batfans, same time, same channel!

Touchline:

Title: *Batman – The Caped Crusader.* ***Supplier:*** *Ocean, 6 Central Street, Manchester.* ***Tel:*** *061 832 6633.* ***Machine:*** *C64.* ***Price:*** *£9.95 (cass).*

Robocop





The race for the Christmas number one spot didn't go according to plan. While everyone was expecting a three-cornered fight between *Operation Wolf* (the eventual winner), *Afterburner* (the favourite) and *ThunderBlade*, *Robocop* upset the odds, giving Ocean an unprecedented 1st and 2nd, and is now poised to take the top slot itself.

Based on the recent film, *Robocop* is set in Detroit, and begins just after Patrolman Murphy has become the 32nd cop to be gunned down in Detroit since Security Concepts Inc. took over the police department. Although this is bad news for Murphy, it's just what OCP have been waiting for, so they take what's left of him, erase his memory, add a programmed mind and a titanium body, and turn him into Robocop – the future of law enforcement (naturally, this doesn't go entirely to plan, and part of Murphy's memory remains). So you take the controls of this killing machine, and set out to track down your killers and arrest them, which means "blow them away" in this game.

Robocop is controlled through joystick moves that allow him to walk left and right across the sideways-scrolling screen, climb up and down stairs, crouch to avoid flying bullets, jump and fire in five directions. The screen display shows the seedier side of Detroit, packed full of alleys, windows and doorways that could hide an assassin waiting to make you the 33rd cop to be killed...

The game consists of nine levels or patrols in which our metallic hero guns it out with murderers and thugs. Level one involves a straight shooting match in which you'll have to learn how to turn and shoot accurately to take out gunmen that appear at windows before they get you.

You're armed with a standard issue police pistol, but this can become far from standard by collecting bonus objects that appear as a reward for gunning down villians and increase your gun's firepower. It can eventually fire in three directions at once, so you can take out three bad guys with a single shot in true western style. Above the main screen display, there is the time left in the patrol clock, the all-important score and a power rating that is shaped everytime you're hit, but can be recharged by collecting tins of baby food!

Robocop is more than just another shoot-em-up: by level four you're beginning to match up parts of a photofit picture which, if successful, will lead to the name of the man responsible for your death. This leads you to a drug factory and the rest of the gang, who'll stop all but the best in their robotic tracks.

Success here reveals that the gang leader is none other than OCP director Dick Jones. Unfortunately, directive four of your programming forbids you to act against an OCP director, which results in you being disarmed and sent out to face the robot ED209 armed only with your bare steel fists.

By level nine you're back at OCP headquarters and you confront the board of directors with the evidence against Jones, who reacts by trying to escape by taking the president hostage, who in turn immediately sacks Jones, cancelling directive four and leaving you to do the rest.

Robocop manages to recreate the atmosphere of the film in pixels and animation that will have you reaching for the fire button at the slightest sign of trouble. This was a surprise hit of 1988 that will definitely set the pace for 1989.

Touchline:

Title: *Robocop.* ***Supplier:*** *Ocean, 6, Central Street, Manchester,* ***Tel:*** *061-832 6633.* ***Machine:*** *C64.* ***Price:*** *£9.95 (cass).*

Legend of Blacksilver



The source of all magic on the planet of Bantross lies in an unprepossessing mineral called Blacksilver. Nothing special to look at, it is nevertheless many times more precious than gold. It can lead to untold power, especially when it falls into the hands of potential megalomaniacs.

Such a perilous state of affairs currently exists on the island of Thalen. Apart from cataclysmic earthquakes, the king has been kidnapped and is being held to ransom. Desperate for help, the King's daughter, Princess Aylea appears in one of your dreams appealing to you to come forward and attempt to save the world. Why she chose you – a mere peasant – rather than one of her trusted knights is not known, but you feel obliged to take on the quest even though you have previously never left your own valley.

The Legend of Blacksilver is a fantasy role-playing game using the same game system as the *Legacy of the Ancients*, although the scenario has been expanded considerably. Control of the game is simple, commands being highlighted from a menu on the left of the screen, and anyone wanting a game that they can start almost immediately without having to wade through a plethora of manuals and keystrokes should be well pleased.

That's not to say that the game itself is simple. Your quest is long and arduous. There are towns and temples to visit, castles and of course dungeons – all in all some 40 levels packed with traps, treasure and some excellent graphic representations of monsters. You'll need to find gems that allow you to access different exhibits in the archives – the source of most of your knowledge. Although no estimated playing time is given, I would reckon on somewhere in the region of 100-150 hours involvement before you save the world.



Your character has five different attributes – strength, endurance, dexterity, intelligence and charisma. Rather than automatically improving these statistics as you progress through the game, you can visit different training centres where, for a small fee, you can take part in an arcade game. Success or failure here is reflected in the relevant attribute score.

The games are not particularly taxing, but they do show a sort of warped originality – clay pigeon shooting with a bow and arrow for example. Completing certain tasks within the game will also affect your characteristics, so you don't have to rely entirely on arcade skills.

Money is vital to your continued survival. Weapons, armour, food, spells, boats and so on all have to be paid for. Apart from robbing treasure chests, the easiest way of increasing your wealth is to gamble, and there are several games of chance in which you can lose your shirt or make your fortune.

Killing monsters is another way of acquiring gold, although there's obviously a considerable amount of personal risk involved. Perhaps talking your way out of trouble or doing a quick bunk might prove to be a wise decision. 'He who turns and runs away, lives to fight another day' may not be the stuff of legends, but then people only usually sing about dead heroes!

There are nine different spells that you use on your travels, although you'll have to prove your worth as an adventurer before the shopkeepers will let you loose with the likes of 'annihilate' and 'psychic protection'. The successful casting of a spell depends on your intelligence, magical skill level, and where you are when you try to cast it.

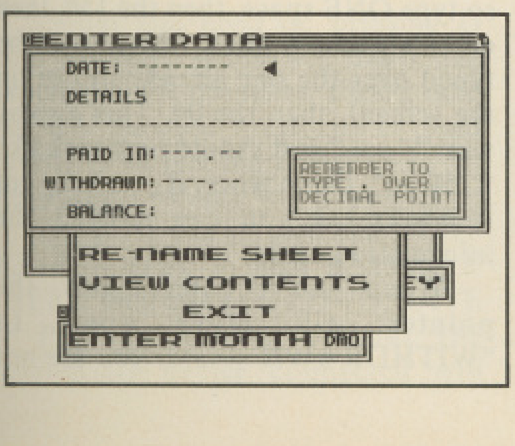
Legend of Blacksilver is a well produced, simple to play RPG. Although lacking the complexity of some of its rivals, you can't help but get carried along by the story. Another one for the collection.

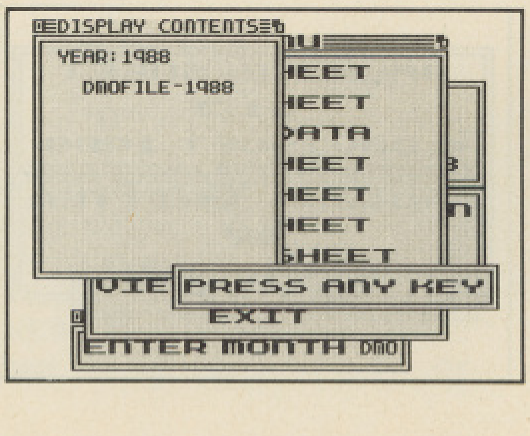
Touchline:
Title: *The Legend of Blacksilver.* ***Supplier:*** *Epyx (U.S. Gold), 2/3 Holford Way, Holford, Birmingham B6 7AX.* ***Tel:*** *021 356 3388.*

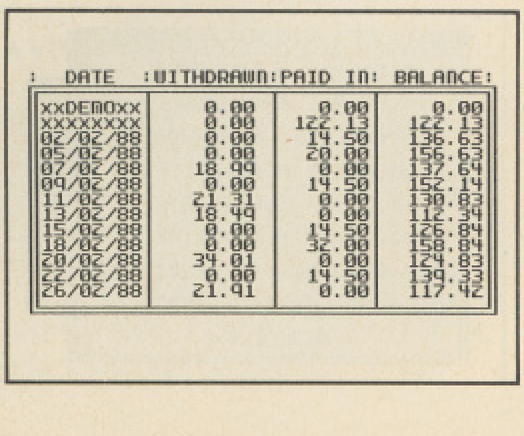


Balance Sheet

A simple and easy-to-use program that'll help you keep track of your bank account







DATE	WITHDRAWN	PAID IN	BALANCE
xxDEMOxx	0.00	0.00	0.00
XXXXXXXX	0.00	122.13	122.13
02/02/88	0.00	14.50	136.63
05/02/88	0.00	20.00	156.63
07/02/88	18.99	0.00	137.64
09/02/88	0.00	14.50	152.14
11/02/88	21.31	0.00	130.83
13/02/88	18.49	0.00	112.34
15/02/88	0.00	14.50	126.84
18/02/88	0.00	32.00	158.84
20/02/88	34.01	0.00	124.83
22/02/88	0.00	14.50	139.33
26/02/88	21.91	0.00	117.42

Balance Sheet has been designed to keep track of your current bank status, and provide you with a statement at any time. Even if you don't have a bank account, Balance Sheet can still be of use to you to help you manage your finances more easily and economically.

When the program is run, you will see the title screen first and then a prompt to 'Enter Year'. Ideally, this should be a four figure number – 1988 for example – but it can be text, if you choose. The purpose of this is to provide each file you save with its own 'code'. As you will use Balance Sheet for more than a year, this means you will want to have more than one file of the same name (files are saved for each month, being named using the first three letters of the month-e.g. SEP for SEPTEMBER) on the disk, therefore each file is given a suffix (the year) to distinguish between, say, JANUARY 1987 and JANUARY 1988.

When you've entered the date (no need to press RETURN), the Main Menu will appear. This lists the main functions of 'Balance Sheet'. To the right of the first option (load sheet), is a pointer. You can move this up and down by using the cursor up/down key. To make a selection from the menu, simply position the pointer next to the function, and press return.

LOAD SHEET – this will prompt you for the three letter name of a file that has previously been saved.

SAVE SHEET – this will again prompt you for the three letter name under which the current file in memory will be saved.

ENTER DATA – this is how you go about setting up and entering transaction details into 'Balance Sheet'. More about this later.

WIPE SHEET – this will prompt you for the name of the file you wish to erase-from the disk: you will be asked if you're sure, just in case you make a mistake. Enter 'Y' for yes, or 'N' for no.

VIEW SHEET – this will display the current file in memory on the screen. Any details are not shown, basically because there isn't room to fit them on the screen! Instead, the details are shown when you print the file – see next entry.

PRINT SHEET – selecting this will present you with a sub-menu – the **Print Menu.** Selection is made here exactly the same as for the Main Menu.

ABORT – will return you to the main menu without taking any further action.

PRINT WHOLE SHEET – will print out the current file in memory (providing your printer is connected and on-line).

PRINT PART SHEET – will print out a section of the sheet only. You will be-prompted "FROM RECORD" and "TO RECORD". Your input must be in two digits: for example, if you entered for 'FROM RECORD' 06, and 'TO RECORD' 11, then only these entries and those between will be printed. Both entries cannot, of course, be less than one, and the second entry must be larger than the first.

CHANGE PRINT FORMAT – this will produce yet another sub-menu, which is again-used like the main and print menus. The first option is PRINT MENU, and will return you to the print menu. The other options consist of PRINT SLASH ZERO, PRINT BOLDFACE, PRINT EMPHASISED, PRINT NLQ and PRINT ITALICS. These options should work on any Epson compatible printer. To select a function, simply place the pointer next to it, and press return to turn it on. Press return again to turn it off. A white square will appear next to it to indicate that the function is on. The function stays on until it is turned off, or until the sheet is cleared from memory (see later). Any number of functions can be on at the same time.

RE-NAME SHEET – this will prompt for two inputs – the name of the file you wish to re-name, followed by the new name (no need to press return).

VIEW CONTENTS – this will list all the current files on the disk for a particular year, note only the files on disk for the current year will be displayed – i.e. if the year is, say, 1988, and you have on disk four files saved from 1987, and three from 1988, then only the ones that were suffixed with 1988 will be displayed. To display the files from 1987, you will have to change the year – see later.

Finally, EXIT will return you to the Power – Up Screen. You will be prompted 'ARE YOU SURE' first, in case you accidentally select it.

Now to the ENTER DATA option. Selecting this option will open a specially formatted window in the top portion of the screen. The best way to show you how to create a sheet is with an example:

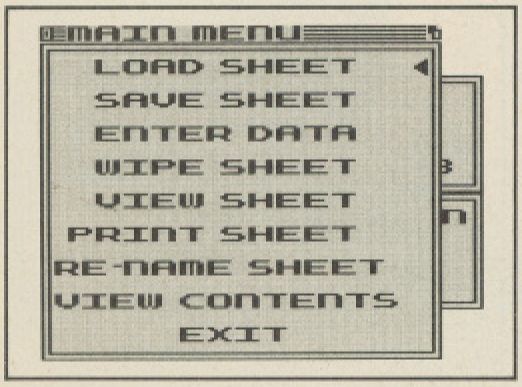
Suppose you are starting afresh a new sheet for, say, February. The first thing you want to do is to let the computer know how much you have in your account. For the sake of argument, let's suppose it's £150. First you are required to enter the date. As you're not actually making an official transaction, what I do is to fill out the date with stars, so you can do this too (no need to press return).

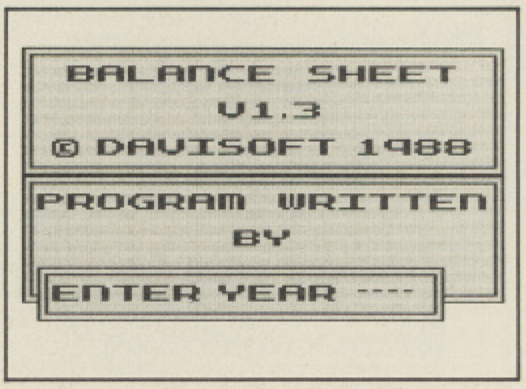
You will notice once you have done this that the pointer to the right moves down to indicate from which section Balance Sheet is expecting input.

The next input is for details of the transaction. As it is the first entry, enter "BALANCE CARRIED", or something similar. The maximum entry allowed is 38 characters. Press return once you have done that, and you'll see the pointer move down again.

Now you must enter the amount to be paid in. In this case it's £150, so type ONE space, then the 150, then enter a decimal point (this should be typed over the one already shown on the screen), then the 00. This display was: "----.--" and should now look like " 150.00". Don't worry if you have got it wrong, as you can re-enter the information again.

When you've entered this, the pointer will move down to "WITHDRAWN ----.--". you are not





making a withdrawal, so just press return. The computer will enter "0.00" for you. The message 'CORRECT? (Y/N)" will appear across on the right-hand side.

If you've done any of the above wrong, then press N, and you can do it again. Pressing Y will display your balance. Press another key to return to, the main menu.

Now let's suppose that on the 4th of February, you withdraw £20.45, for whatever reason. Select Enter Data as before, and enter the following for the date: "04/02/88". Then you can enter anything you like for the details. You are not paying in anything, so press return, and the computer will fill out the space with "0.00". For WITHDRAWN, enter two spaces, then 20.45. (remember to enter the decimal point as well).

If you've done that correctly, press Y, and your new balance will be calculated, and diplayed. Press any other key to go to the main menu. You can select from the menu VIEW SHEET, to see what you have just typed in (except for the details), or you can select PRINT SHEET to obtain a hard copy (statement).

The file can be saved using the SAVE SHEET option. Any three-letter name can be used, but it's best to call each file the month it is related to, i.e. "FEB". As long as you entered the year as 1988, then it will appear under VIEW CONTENTS as "FEBFILE-1988".

Other Functions

Holding down the CBM key (bottom left of keyboard), and the F1 key (top right of keyboard) when on the main menu, will clear any sheet in memory and present the title screen. You will then be required to re-enter the years.

Holding down any key during printing will terminate printing, and return you to the main menu. Pressing the escape key (left arrow), again from the main menu, will allow you to re-enter the year without clearing the memory.

Should you need to, pressing D from the main menu will delete the last entry from the sheet. Please note that this function must not be used directly from loading a new sheet (as the previous balance will not exist).

Finally, if you've used the DISK-BOOT program to load BALANCE SHEET, then using the LOAD, SAVE or PRINT options without the appropriate device connected will cause the computer to crash, and any sheet in memory will be lost.

If you encounter a 'file not found' error when trying to load a file that you know exists, then the most likely fault is that the year is not set right. For example, you will get an error if the year is currently set at 1987, and you are trying to load JAN 1988.

Getting it all in

The following are the instructions for typing in and saving 'Balance Sheet'. Remember – don't run any program until you've saved it first. Please read the following through thoroughly first, so you are sure of what to do.

1. Type in LISTING 1, and save it as "LIST1". Check and double-check that it is correct.
2. Type in LISTING 2, the U.D.G.s, and save it as "LIST2". The program has a built-in checksum, and will inform you of any error.
3. Type in LISTING 3, the windows machine code program, and save it as "LIST3". Again, the checksum will inform you of any error in the data.
4. Now re-load "LIST2" and run it. Type "POKE 53272,31" (return). You should see the character set change. Type "NEW" (return), and then type in LISTING 4, the windows creator program. Because this program uses mostly keyboard graphics, it's unlikely that you will hit on the right symbol every time. Typing in this program with the new character set selected will let you see more easily if you have got it right or wrong. Save the program as "LIST4".
5. Now type in LISTINGS 5, 6 and 7, and save then as "LIST5", "LIST6", "LIST7" respectively.

Now that you've typed in and saved all these BASIC programs, it's time to create the machine code versions of them, and save them in the correct way onto the program disk. Have a new, formatted disk ready to recieve the programs. When you have the complete set of programs saved on this disk the directory should appear as:

```
1     "SHEET"
1     "A"
5     "B"
4     "C"
32    "D"
25    "E"
```

To obtain the program in its completed form as shown above, do the following:

1. Load "LIST6", and run it. Type "NEW" (return), and load "LIST7". Place the program disk in the drive (the one you have just formatted). Type RUN (return). The drive should run for a few seconds. To test that the BOOT program has been saved correctly, turn your computer off, then on, and LOAD"SHEET",8,1.

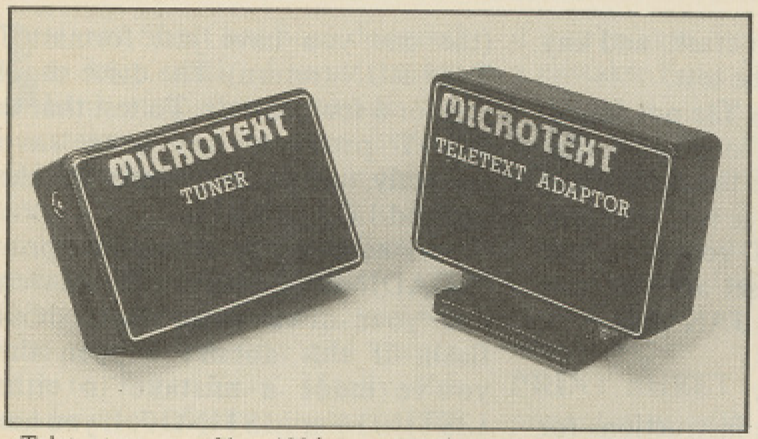
As soon as the computer prints "LOADING", the screen should clear, and your drives error light should flash. If this doesn't happen then you've made a mistake in either LISTING 6 or LISTING 7. If you have made a mistake then correct it, and change line 50 in LISTING 7 to read: 50 SYS57812" :SHEET",8,1 and have another go.

2. Turn the computer off then on, and load "LIST5". Run the program, then type the following in direct mode: POKE43,253: POKE44,31 (return) POKE 45,89:POKE46, 32 (return). Insert the program disk and SAVE"A", 8, 1 (return).
3. Turn the computer off then on, and load "LIST2". Run the program, and type the following in direct mode: POKE53272, 31 (return), to make sure the U.D.G's are in memory. TYPE POKE43, 253: POKE44, 55 (return). POKE45, 9: POKE46, 60 (return). Insert the program disk and SAVE"B", 8, 1 You can check that the U.D.G's have been correctly saved by turning the computer off then on, and loading "B", 8,1. POKE53272, 31 should reveal the U.D.G's back in memory.
3. Turn the computer off then on, and load "LIST3". Run the program. Insert the program disk and type the following in direct mode: SYS52224, "C", 8 (return). The drive should operate for a few seconds.
4. Turn the computer off then on, and load "C", 8, 1 from the program disk. Load "LIST1", and run it. You should see all the windows used by the program flash up on the screen. When the program has finished running, insert the program disk, and type SYS52248,1,"D", 8 (return). The drive should operate for a few seconds.
5. Turn the computer off then on, and load "LIST1" – the Basic program. Insert the program disk and SAVE"E", 8 (return).

All the separate programs to Balance Sheet are now on the program disk. LOAD"SHEET", 8, 1 now, should make the program LOAD, then RUN automatically. (The screen will blank during loading)

If you don't want the program to 'BOOT', then you can LOAD"A",8, 1 and then type SYS8202 (return).

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Soccer Simulators





"These four games are absolutely brilliant! Everything you could possibly want in computer soccer – these games have it all! Amazing playability!"

That's how Code Masters, the company that first made its name in budget software but has now turned full price, modestly describes its latest four-pack football offering. Unfortunately, the games are far from brilliant, remarkably unfriendly to use and contain many inadequacies that will hardly satisfy a football fanatic.

Two cassette tapes with a program on each side are accompanied by a poster of football greats, and a sheet of brief instructions. It's up to you to decide which game you'll play and for how long. Having said that, all the games have the same user-unfriendly front end that offers you the chance to choose between a one and two-player game, select controls, read on-screen instructions and select other appropriate options.

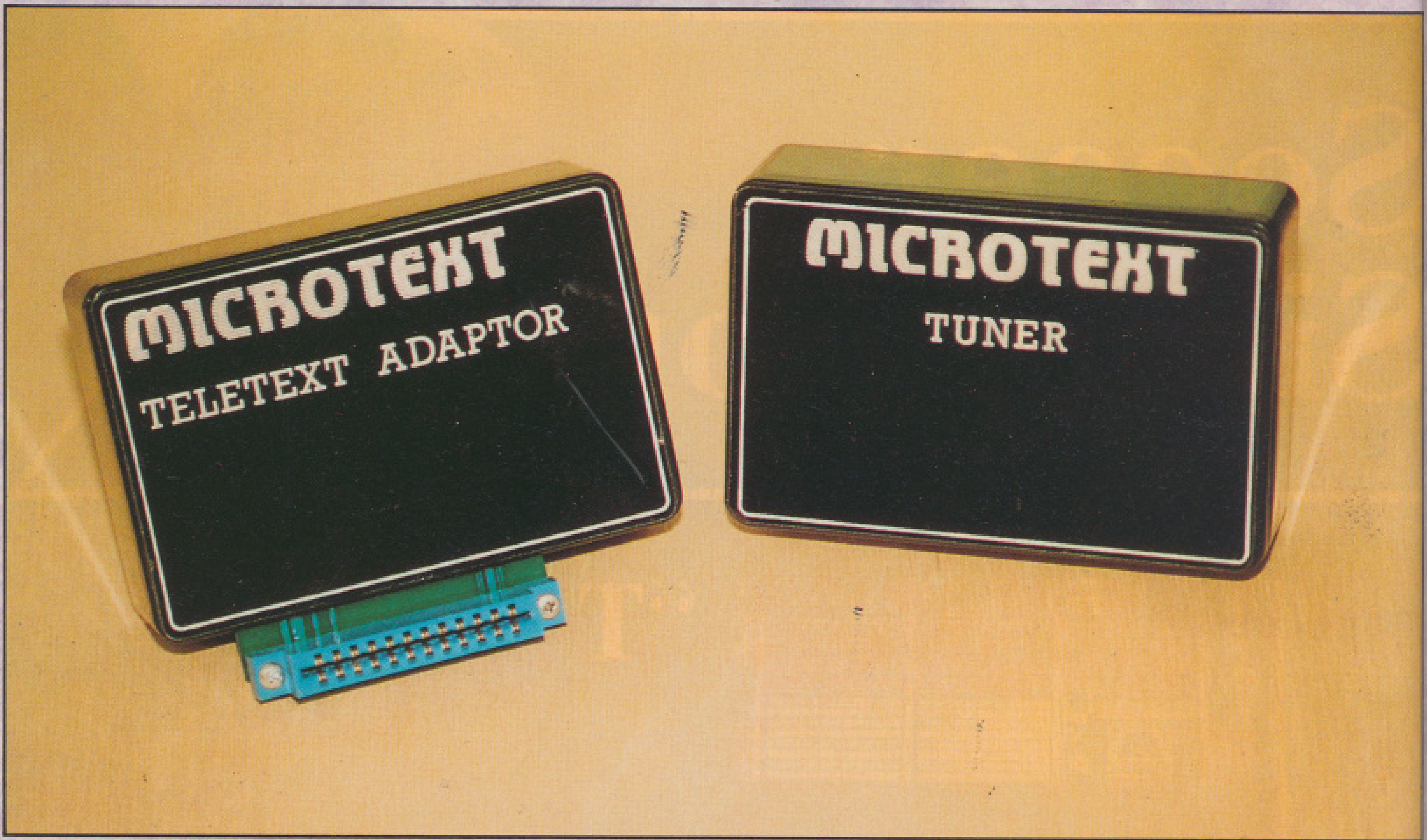
As far as I know, most C64 owners possess a joystick and will think it a nuisance to have to use keyboard controls to select the joystick every time they load in the game: they'll think it's appalling to have to go through this procedure everytime they play a match, particularly five a side game that lasts only a few minutes.

The football games, 11-a-side, 5-a-side and street soccer are all played in psuedo 3D, which just doesn't seem to work. The worst offender is the street soccer, which is played in a road containing nice obstacles such as parked cars and open garages. Unfortunately, should a computer opponent stray into a garage, he'll get stuck between the car and the garage wall, bringing the action to an abrupt halt.

In the 5-a-side game, attacking players aren't allowed in the goalkeeper's circle, but this only seems to apply to human players – when I was playing, a computer player dribbled the ball up to the goal line to score!

You may consider these to be minor niggles or serious faults, depending largely on your idea of football, and you may consider that four games for the price of one is good value (the fourth being a skills and training program), but for my money four budget games do not a full priced game make, and shouldn't be sold as such. Perhaps the 11-a-side and 5-a-side game together would make a good £1.99 or £2.99 game, but at £9.99 it's just not in the same league.

Touchline:
***Title:** 4 Soccer Simulators. **Supplier:** Code Masters, P.O. Box 6, Leamington Spa, Warks., CV33 0SH. **machine:** C64. **Price:** £9.99 (cass).*



Miraculous Microtext

Even if you can already access teletext, this unit adds dimensions undreamed of.

By Eric Doyle

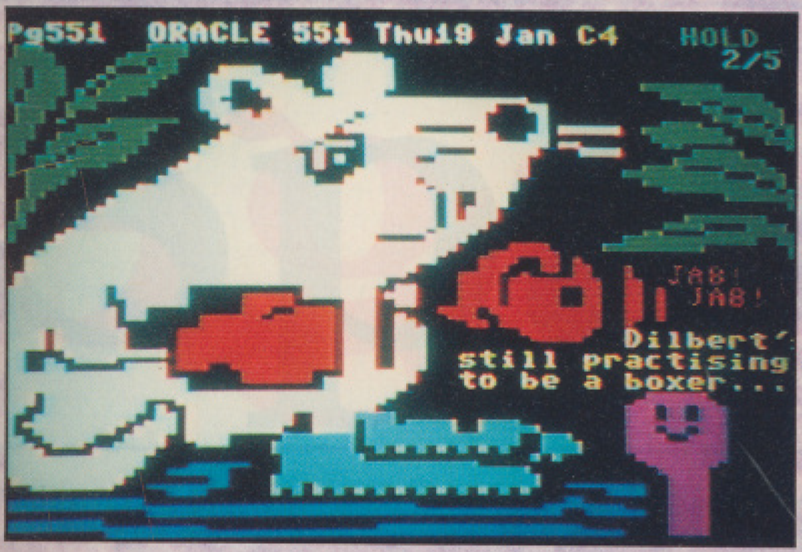


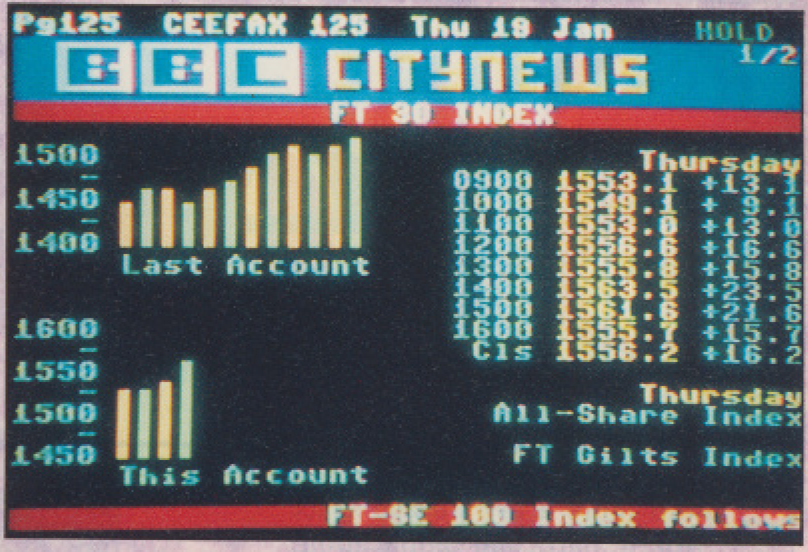
Since the BBC and ITV launched their respective Ceefax and Oracle services, remote controls have sprouted dozens of extra buttons, and teletext is now as familiar as *Coronation Street*. Many homes already have teletext TVs, so why should they want an adaptor for their computer?

Although the Microtext teletext adaptor is pretty uninspiring to look at – the typical black box syndrome – it is the key to an exciting new approach to Ceefax and Oracle. Effectively it turns a computer into a programmable hand control with extra facilities which cannot be found anywhere else.

The adaptor itself connects to the User Port on the computer and takes its input from the Video Out socket of a video recorder or from Microtext's own tuner (in both cases all necessary leads and software are supplied). Personally I prefer using the separate tuner because it means that the unit can be used in my room, rather than battling with the rest of the family for use of the video.

When I described the unit as a black box, that is exactly what I meant. There are no knobs or dials to twiddle, and the only connection is the DIN socket which feeds the signal in. The tuner is equally anonymous with its signal out, aerial in and 12V supply sockets.





Signal Strength

Having installed everything in my room, I came upon the first problem – no aerial. Rather than moving everything down into the living room, I decided that I would indulge in an experiment. Casting all caution to the wind and sparing no expense, I plunged into the wardrobe and emerged with an all-purpose, metal coat hanger. Leaving a trail of freshly ironed shirts in my wake, the hanger was soon transformed and installed as a serviceable aerial. Now for the severest test.

Loading the supplied software took seconds – it automatically detected that the Microtext tuner was being used rather than a video recorder and proceeded to scan the wavebands for a suitable signal. I knew it wouldn't work because, apart from the improvised aerial, I live in a weak signal area and the presence of an enormous cathedral nearby doesn't help. Surprisingly, after a few seconds I was presented with a line of text indicating that the Tyne Tees transmitter had been contacted. This amazed me because I live in the Yorkshire Television area. Accepting this as a source, I let the search continue and soon had all of the YTV and BBC stations pinned down. Amazing! Once a station is sensed it can be allocated its own key on the computer so that channel switching is merely a case of pressing two keys.

Now came the true test – picture quality. As I expected, the TTTV screen was a total mess, but I could get a reasonable picture of the index if I left it on the screen for a few passes. The other four channels were excellent but BBC2 had a few glitches – perhaps I should buy a multi-element coat hanger for future use.

Once the software has done this initial search, it can be resaved so that the channels are fixed for future use. This also makes it all easier to use than the video link-up where the channel.

At this point I remembered that somewhere in my academic past I'd acquired an indoor aerial for an old set which had long since gone to the great reception area in the sky. Ransacking my room, I emerged, grinning jubilantly from a pile of memorabilia clutching the sought-after trophy in my hand.

With a better aerial the BBC2 picture improved but that's about all, hardly worth the effort. During a lull in household proceedings I managed to set up the equipment near to the aerial socket from our glorified, roof-mounted, coat hanger. This further improved the image so that now Tyne Tees was almost acceptable.

The Advantages

In short, the adaptor works perfectly to give a picture which is actually better than the 'real' thing. All that appears on the screen is generated inside the Commodore, and this means that the pictures can not only be printed out or stored on disk for future use but the whole teletext process can be programmed.

The manual is excellent because all of the key routines are fully documented so that any user can write a very powerful Basic program. In this way it is possible to select individual pages on any or all channels and save them or print them out (or both). The time saved is phenomenal because the program can run while you get on with something more important, the days of sitting waiting for the correct screen to come round a thing of the past.

On disk, each screen only uses four blocks which means that in theory 166 could be stored on each disk. The only problem is that the directory only has room for 144 entries so a copy of the master program and its machine code patch may as well be stored on each disk at the negligible cost of two screens.

The uses of the system depend upon individual needs. If you're a football fan then all of the results can be stored for future reference, tele addicts can work out a complete daily viewing schedule or soap fans can keep a record of the story so far.

The only problem is the cost of the units, £69.95 for the adaptor and £114.80 for the adaptor plus the tuner. The system renders teletext systems as something similar to Micronet without the user interaction, the price is not so high. After all, a modem would cost at least as much but on top of that would be the fees for accessing the system, which isn't the case with teletext. The Microtext teletext adaptor is highly recommended for those who can't be bothered with baud rates or panic about parities. It is a marvellous unit and so simple to use. Even if you dream of upgrading to the Amiga, you have no excuse because an Amiga Upgrader can be supplied for £34.90.

In many descriptions of the future, the concept of a tailor-made newspaper that is prepared while you dress to be read at breakfast commonly occurs...this brings the future one step closer. A truly excellent utility which should ensure the future of coat hangers in my household!

Touchline:
Supplier: *Microtext, 7 Birdlip Close, Horndean, Hants PO8 9PW.* ***Tel:*** *(0705) 595694.*

Storage

Need more array storage space for a particular application? There aren't many options available. Relative files can effectively extend memory, but there are drawbacks, for example speed of recall. This is slowish, especially for accountancy-type programs needing mathmatical treatment, because each record has to be read before the calculations.

Another problem is wear and tear on the 1541. Of course you can compile your program and create a bit more room for arrays and variables in the Basic storage area, but if you've already done this and still need more array storage, then what follows may be useful to you.

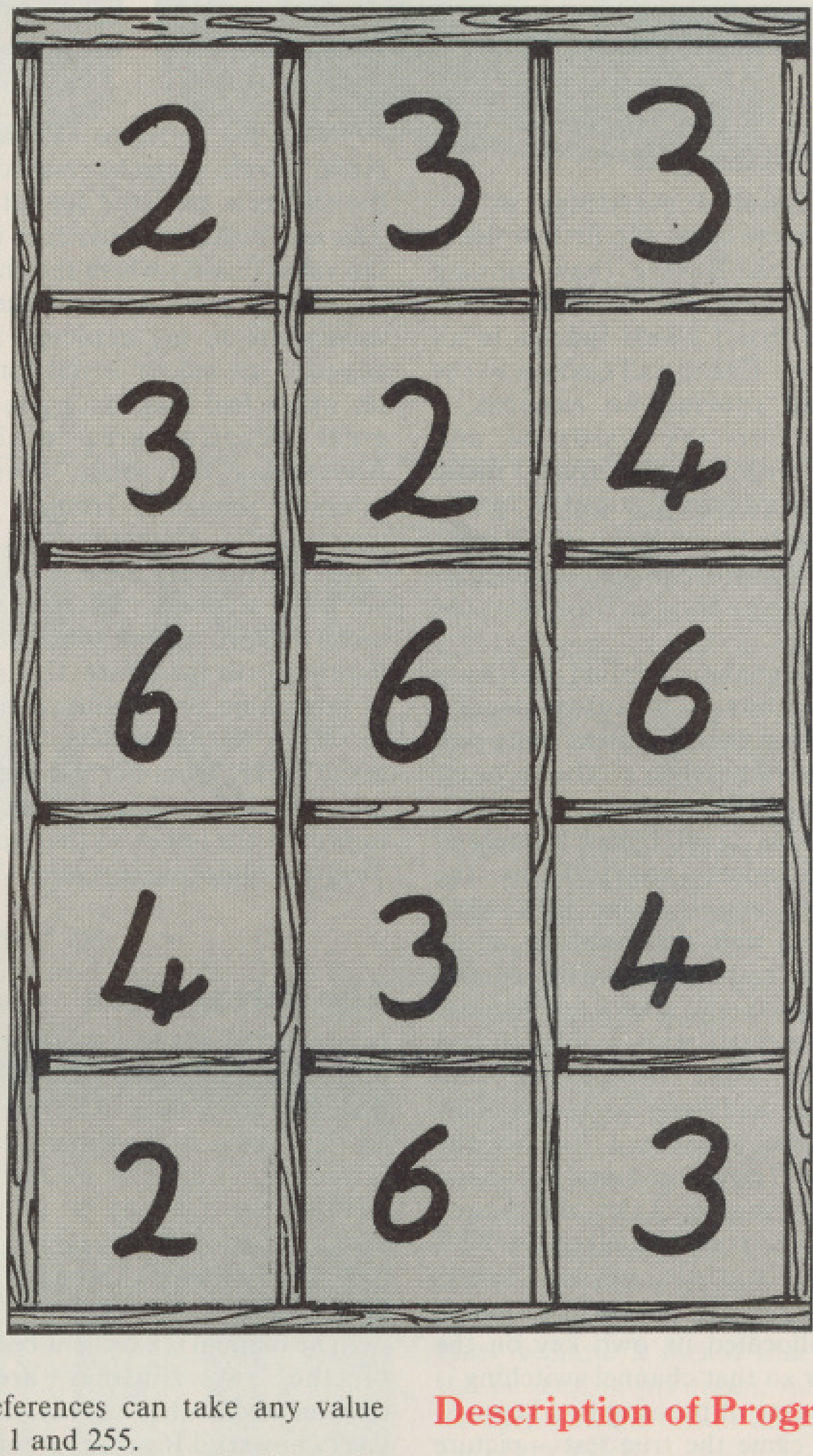
Unused Memory

The 64 has two 8k Ram areas which are often unused and are unavailable to Basic. These are the Rams behind the Kernal and Basic Roms. If you're using a compiled program, the compiler will probably be using the 8k or Ram behind the Basic Rom for its library of routines, but this still leaves 8k of Ram behind the kernal capable of array storage.

Obviously if your program is uncompiled, you have 16k available to you behind both Kernal and Basic Roms. The 4k of memory from $C000(49152) onwards is also available, provided you haven't already used some of it for a machine code routine.

So assuming a compiled program is already in use (for speed and efficient memory usage), the program which follows uses part of the area above $C000 for a machine code routine and array reference store, and stores the array data strings under the Kernal Rom ($E000 upwards), giving an extra 8k of array store all instantly available.

The Program is arranged to store strings of up to 46 characters in length, giving 400 records if the average string length is 20 characters. The X and Y array references can take any value between 1 and 255.



The number of records able to be stored depends on the average length of the strings, up to a limit of approximately 800 fixed by the array reference store (Index array) space. It's easy to increase the maximum string length which can be handled – this is dealt with later.

Description of Program

The whole consists of four parts:

1. Basic program to act as subroutines from within your application to Read, Write and Amend the array.
2. Machine code to carry out the actual operations, located $C000-$C136.

Space

How to extend your Array Storage facilities

by Brian Halesworth.

Figure 1

```
 SOURCE CODE
5 PRT
10 ; KROM/RAM ARRAY STORAGE
20 ; FILENAME SC-KROM/RAM STOR
30 ORG $C000
40 START1 = $C150
50 START2=$E000
60 ZP = $FB
70 LEN1 BYT 0
80 RECNO BYT 0
90 COL BYT 0
100 INADD1 BYT 0 ;NEXT VACANT INDEX
110 INADD2 BYT 0 ; ARRY ADDR LO/HI
120 STADD1 BYT 0 ;NEXT VACANT STRG
130 STADD2 BYT 0 ; ADDR LO/HI
140 MAXREC BYT 0
150 BYT 0 ;TOTAL NO OF RECORDS
160 SCHPTR BYT 0
170 BYT 0 ;SEARCH COUNTER
180 AMND BYT 0
190 INIT LDA #< START1
200 LDY #> START1
210 STA INADD1
220 STY INADD2
230 LDA #< START2
240 LDY #> START2
250 STA STADD1
260 STY STADD2
270 RTS ; END OF INITIALIZE
280 ; **** WRITE CODING ****
290 WRITE LDA INADD1
300 LDY INADD2 ;GET BYTES OF NEXT AD
310 ; OF INDEX ARRY
320 STA ZP ; STORE IN ZERO PAGE
330 STY ZP+1
340 LDY #0
350 LDA LEN1
360 STA (ZP).Y
370 LDA RECNO
380 INY
390 STA (ZP).Y
400 LDA COL
410 INY
420 STA (ZP).Y ; LEN RECNO COL STRD
430 LDA STADD1
440 INY
450 STA (ZP).Y
460 LDA STADD2
470 INY
480 STA (ZP).Y ; LO/HI BYTES OF THE
490 ; STR ADDRSS PUT IN INDEX ARRY
500 CLC
510 LDA INADD1
520 ADC #5
530 STA INADD1 ; LOB ADVD TO NEXT
540 ; INDEX ARRY START ADDRSS
550 LDA #$00
560 ADC INADD2
570 STA INADD2 ; DITTO FOR HI BYT
580 LDA STADD1
590 LDY STADD2
600 ; ZP CAN NOW BE USED FOR STRG
610 ; ARRAY ADDRSS PTR
620 STA ZP
630 STY ZP+1 ; LO/HI OF STRG ADDRSS
640 ; SET TO ENABLE STG WRITING
650 SEI
660 LDA #%00110101 ;CODE KROM OUT
670 STA $01
680 LDY #$0
690 RDBUFF LDA BUFF.Y ; GET 1ST CHAR
700 STA (ZP).Y ; STORE IN STRG ARRY
710 INY
720 CPY LEN1 ; END OF STRG ?
730 BCC RDBUFF ; NO DO NEXT
740 LDA #%00110111 ;ALL WRTNG DONE
750 STA $01 ;KROM SWITCHED IN
760 CLI
770 CLC ;ADV STRG ADDR FOR NEXT WRITE
780 LDA STADD1 ; LOB STR ADDRSS
790 ADC LEN1 ; ADVANCE TO NEXT VACA
800 ; STRG ADDRSS
810 STA STADD1 ;STORE IT
820 LDA #$00
830 ADC STADD2 ; DITTO HIBYT
840 STA STADD2 ;STORE IT
850 EXIT RTS
860 ;BUFFER WRITTEN TO STRG ARRY
870 ;ADDRSS FOR NEXT INDEX & STRG
880 ;UPDATED INDEX ARR HOLDS PARAMS
890 ;
900 ; **** READ CODING ****
910 LDY #0
920 STY SCHPTR ; INITIALIZE SCHPTR
930 STY SCHPTR+1
940 LDX #< START1
950 LDY #> START1
960 STX ZP ;LOB OF START OF INDX ARY
970 STY ZP+1 ;HIB OF STRT INDX ARRY
980 TEST1 LDY #1 ; OFFSET TO REC
990 LDA RECNO
1000 CMP (ZP).Y ;IS THIS REC ?
1010 BNE ADV ;REC NOT FND ADV ADDR
1020 LDY #2 ;REC FND OFFSET TO COL
1030 LDA COL
1040 CMP (ZP).Y ; IS THIS THE COL?
1050 BEQ RSTRG1 ;BOTH FOUND READ/AMND
1060 ADV CLC ;BOTH NOT FND ADV INADD
1070 ;TO NEXT INDEX ARRY ADDRS
1080 LDA ZP
1090 ADC #5
1100 STA ZP
1110 LDA #0
1120 ADC ZP+1
1130 STA ZP+1
1140 LDY SCHPTR
1150 INY
1160 BNE SKIP ;LOB NOT PASSED $FF
1170 INC SCHPTR+1 ;LOB PASSED $FF
1180 SKIP STY SCHPTR ;NEW LOB COUNTER
1190 CPY MAXREC ;ALL RECS SEARCHED?
1200 BCC TEST1 ;NO DO NEXT REC
1210 LDY SCHPTR+1 ;YES BUT CHK HIB
1220 CPY MAXREC+1 ;ALL RECS SEARCHED
1230 BCC TEST1 ; NO DO NEXT REC
1240 LDA #1 ;YES BUT NO REC FOUND
1250 STA LEN1 ; SET FOR 1 CHAR
1260 LDA #45 ; CHR$ FOR "-"
1270 STA BUFF ; RETURN REC AS "-"
1280 RTS ; NO RECORD EXIT
1290 RSTRG1 LDX AMND ;SINCE BOTH REC
1300 ;& COL NOW FOUND PREP TO RD STRG
1310 ;BUT FIRST CHECK FOR AMEND
1320 CPX #55 ;IS IT AMEND
1330 BEQ RESET ;YES PREP TO AMND STRG
1340 LDY #0 ;NO PROCEED TO READ
1350 LDA (ZP).Y ;GET LENGTH
1360 STA LEN1 ; STORE LENGTH
1370 LDY #4 ;OFFSET TO HIB STRG ADDRS
1380 LDA (ZP).Y ;HIB OF STRG ADDRSS
1390 STA $FE ; STORE IT
1400 DEY ; DEC PTR TO LOB
1410 LDA (ZP).Y ; LOB OF STRG ADDRSS
1420 STA $FD
1430 SEI
1440 LDA #%00110101 ; CODE KROM OUT
1450 STA $01 ; SW KROM OUT
1460 LDY #00
1470 RSTRG2 LDA ($FD).Y ; GET CHAR
1480 STA BUFF.Y ; PUT IN BUFFER
1490 INY
1500 CPY LEN1 ; LAST CHAR ?
1510 BCC RSTRG2 ; NO GET NEXT
1520 LDA #%00110111 ; YES ALL CHARS
1530 ; NOW TO SW IN KROM
1540 STA $01 ; KROM BACK IN
1550 CLI
1560 RTS ; ALL READING DONE
1570 ; AMEND CODING TO REMOVE
1580 ; EXISTING RECORD BY SETTING
1590 ; LEN1 REC & COL TO ZERO
1600 ; IN THE INDEX ARRY
1610 RESET LDA #$0
1620 LDY #0 ;OFFSET TO LEN
1630 STA (ZP).Y ;RESET LEN1 ZERO
1640 INY
1650 STA (ZP).Y ;RESET REC ZERO
1660 INY
1670 STA (ZP).Y ;RESET COL ZERO
1680 JMP WRITE ;WRITE NEW AMNDED STRG
1690 BUFF BYT 0; READ/WRITE BUFFER
1700 BYT 0
1710 BYT 0
1720 BYT 0
1730 BYT 0
1740 BYT 0
1750 BYT 0
1760 BYT 0
1770 BYT 0
1780 BYT 0
1790 BYT 0
1800 BYT 0
1810 BYT 0
1820 BYT 0
1830 BYT 0
1840 BYT 0
1850 BYT 0
1860 BYT 0
1870 BYT 0
1880 BYT 0 ;END OF R/WRTE BUFFER
1890 END
```

3. Array Index store created by the operators m/c holding the parameters of each array string and its location. This is created by the M/C during Write operations, and is located from $C150 (just above the operator M/C).
4. String Store located from $E000 onwards under the Kernal Rom.

Index Array Store $C150(49488) Upwards

This holds the refences for each String stored in the array. The conventional two dimensional array is A$(X,Y). I've called the X value REC and the Y value COL (abreviations for Record No. and Column No – this gave me a better mental picture), although I've used X and Y in the Basic to transfer the requisite array block references. Thus the Array Index holds the following in regular 5 byte blocks:

1st byte LEN length of the string
2nd byte REC ie X value
3rd byte COL ie Y value
4th bye Lobyte of string address
5th byte Hibyte of string address

Thus a search up the Index array in 5 byte steps will find REC and COL (if they exist), hence LEN can be found, as well as the address at which to read the string.

No Blanks – "-" Or Nulls Stored

If a search of the index array fails to find a particular X,Y combination, the M/C generates a "-". There are thus no "-" or null strings stored in the array, which saves both index and string store memory, particularly as in many array applications the array consists mainly of blanks or nulls!

Description of M/C

Read this in conjunction with the source and m/c listing. (fig1). After some address definitions, lines 70 to 180 set the variables, most of which will be obvious, but some merit some reference.

INADD1&2 always contain the lo/hi address of the start of the next Index array to be written to (initially $C150 & C151).

STADD1&2 similarly always contains the start of the next String address to be written to (initially $E000 under Krom).

MAXREC and its next byte (lo/hi) always contains the total number of strings which have been written, ie. No. of X,Y combinations.

SCHPTR and its next byte (Lo/Hi) is a search counter used by the m/c program to keep track of its search loop.

AMND is a single byte flag used to define when an Amend is to be carried out.

Lines 190-270 are the initialization routine, hence a SYS49164 ($C00C) must be called once at the beginning of your Basic Program, the m/c reutrning via the RTS in line 270, having set the start addresses of the Index array and the string store.

Write Operations

Write operations commence in line 290 called by SYS49185 ($C021); the address of the next Index array byte is then obtained, and LEN, REC, COL, STADD1 and STADD2 stored in sequence via lines 290-480, thereby creating the next (or first) element of the Index array store.

Lines 500-570 increment INADD 1&2 by 5 ready for the next write operation. Lines 580-750 get the next string address (STADD1&2), and read the buffer store (which is the string to be stored) into the memory via a loop between lines 690-730. Lines 650-670 & 740-760 deal with interupts and switch the Kernal Rom out and in before and after the actual write to memory operations. Lines 770-840 update STADD1&2 ready for the next write operation, the sequence ending at line 850 with a return to Basic.

Read Operations

Read operations commence at line 900 called by SYS49295 ($C08F). Having set SCHPTR to zero and set the index array start address in ZP&ZP+1 via lines 910-970, it searches for RECNO, advancing up the index array via the branch in line 1010 (testing SCHPTR against MAXREC on the way for end of index), the branch at line 1230 returning to TEST1 at each Index array address advance (all via lines 1060-1230).

If RECNO is found at the branch test in line 1010, it then immediately checks for COL since we're looking for both RECNO and COL in the SAME index array record (lines 1020-1050). The branch line at 1050 shows that both RECNO & COL are found sending operation to lines 1290-1560 to read the string. Failing the branch at 1050 leads directly to 1320-1460 to advance further up the index as above.

Reading the string is the inverse of a Write operation, get string length, get string address, switch out Kernal not forgetting interupts, read string into buffer via the loop in lines 1460-1510, reset Kernal, reset interupts and return to Basic via RTS in line 1560.

Two points to note:
1. Failure at the branch in line 1230 occurs if the particular RECNO/COL combination can't be found in the Index array, and leads on to lines 1240-1270, whereby a Blank character is returned prior to the return to Basic via RTS in line 1280.
2. Immediately on entry to the read string coding (lines 1290-1790), a check is made to see if an amend operation is intended (lines 1290-1330).

Amend Operation

To save coding, this uses the search part of the Read and Write operations to rewrite a 55 and a Read operation is called. The program then finds the Index array record, but on branching to the read String section and AMND check in lines 1290-1330 diverts the program to lines 1610-1680.

If an amend is inadvertently attempted on a RECNO/COL combination not present in the array no harm is done, and the program exits at RTS in line 1280 having set a "-" in the buffer, but without writing anything.

Lines 1610-1680 set LEN,RECNO and COL to "0" in the index array, and then jump to the WRITE coding to write a new record from the buffer at a new string address which will have the original RECNO/COL references in its new index.

Since we don't use a "0" as either a RECNO or COL reference, the old index record and its associated string won't now be found, but the new index and string will. This leaves the Index array and String storage areas containing redundant data, but both will be removed and memory recovered when the array is next saved to disk or tape and subsequently reloaded!

Procedure

To use the array program (having loaded it to memory and called the initialization routine) we need the following actions in our Basic routine.

WRITE
1. Poke string length (LEN), RECNO (x value), COL (y value) into locations 49152, 49153 and 49154 respectively.
2. Evaluate Lo/Hi values of MAX-REC (total number of X, Y records)

Figure 2

```
63  40000 REM ******************************
B1  40010 REM **** COMMUNICATING BASIC *****
A7  40020 REM *** KROM/RAM ARRAY STORE *****
01  40030 REM ******************************
8B  40040 REM
8E  40050 REM *** WRITE TO KROM/RAM STORE *****
39  40060 IFB$="-"ORB$=""THENRETURN
31  40070 M%=M%+1
B2  40080 HB%=M%/256:LB%=M%-(HB%*256)
5B  40090 C=LEN(B$)
F5  40100 POKE49153,X:POKE49154,Y:POKE49152,C:POKE49159,LB%:POKE49160,HB%
5D  40110 FORI=1TOC:POKE49441+I,ASC(MID$(B$,I,1)):NEXTI
5D  40120 SYS49185:RETURN
84  40130 REM ***** READ FROM KROM/RAM STORE ******
91  40140 POKE49153,X:POKE49154,Y:SYS49295
26  40150 C=PEEK(49152):B$="":B1$=""
5B  40160 FORI=1TOC:Z=PEEK(49441+I):B1$=CHR$(Z):B$=B$+B1$:NEXTI:RETURN
25  40170 REM ***** AMEND KROM/RAM STORE ******
72  40180 IFZ$=""THENRETURN
00  40190 GOSUB40130:IFB$="-"ANDZ$="-"THENRETURN
E5  40200 IFB$="-"THENB$=Z$:M%=M%+1:GOSUB40050:Z$="":RETURN
B1  40210 B$=Z$:AM%=AM%+1:M%=M%+1
E7  40220 POKE49153,X:POKE49154,Y:POKE49163,55:C=LEN(B$):POKE49152,C
D3  40230 HB%=M%/256:LB%=M%-(HB%*256)
B7  40240 POKE49159,LB%:POKE49160,HB%
BF  40250 FORI=1TOC:POKE49441+I,ASC(MID$(B$,I,1)):NEXTI:SYS49295
AC  40260 POKE49163,0:IFZ$="-"THENM%=M%-1
6B  40270 Z$="":RETURN
```

and Poke into 49159 and 49160.
3. Poke the string characters into locations 49442 onwards, but beware of limit of length.
4. Call SYS49185.

READ

Poke RECNO and COL into locations 49153 and 49154.
2. Call SYS49295.
3. PEEK49152 for string length
4. PEEK49442 onwards to length of string to reassemble string record.

AMEND

1. Carry out a read operation, if a "-" is returned proceed to WRITE. N.B. You'll probably need a read and display before amending a record to see what was there anyway! If not a "-" character
2. Poke RECNO and COL to locations 49153 and 49154.
3. Increment MAXREC, evaluate Lo/Hi values, poke to 49159 and 59160.
4. Increment a Basic Counter to keep track of the number of amend operations.
5. Poke 55 to 49163 (AMND Flag).
6. Poke new string length into 49152.
7. Poke the new string characters to 49442 onwards
8. Call SYS49295 (Read Operation).
9. Poke 0 into 49163 (Reset AMND).

Obviously, the three proceeding Basic operations would be subroutines to be called as needed within your program.

Fig 2 shows the Communicating Basic routines ready for use as Gosubs, B$ is the Write and Read Input/Output string variable, whilst Z$ is the Amend Input variable, thereby enabling checks to be carried out.

The Communicating Basic shown also enables a record to be deleted using the AMEND operation by Inputing a "-" character.

Loading and Saving the Array

Figure 3 shows the coding needed to save a sequential file of the array and is conventional, apart from the following points. M% is the Basic counter for MAXREC the total number of records.

AM% is a counter for the number of amend operations carried out, since each amend operation increments M% but resets the original record (up to now still in memory) so that it cannot be read, it is necessary to decrement M% by the number of amend operations. This is carried out by line 50070.

Since the original of the amended record cannot be read, the save operation removes it from the array file, and on reloading the memory space it used is thereby recovered. An unusual garbage collect routine!

Lines 50140/50150 read the array and prevents blank records being written to the file – since blanks are all generated by the m/c program, they're not filed.

It's essential to save MAXREC, and usually necessary to know the range of X and Y values in the array – these are saved as M%,M and N. Note that in lines 50160-50180 the particular X,Y values are saved with each string.

Unlike most sequential files, the load program does not have to be a mirror image of the save program. MAXREC is the number of records in the file, so a simple loop of MAXREC (via test in 50320) reads every item. Since each record includes its X,Y value, the whole array is easily reconstructed using the Write operation.

Obviously for Tape operations all the OPEN and CLOSE commands need suitable corrections.

Figure 3

```
4E  50000 REM ******************************
47  50010 REM **** DISK LOAD AND SAVE *****
B6  50020 REM ** KROM/RAM ARRAY STORAGE ***
74  50030 REM ******************************
B4  50040 REM
F1  50050 REM ****** WRITE RECORDS TO DISK ******
C9  50060 PRINT:PRINT"[SPC5,RVSON,SPC6]SAVING FILE[SPC6,RVSOFF]"
4E  50070 M1%=M%-AM%:REM RESET VALUE OF M% READY FOR THE NEXT READ
1F  50080 OPEN9,8,9,"FILENAME,S,W"
EC  50090 PRINT#9,M:REM MAX VALUE OF X
20  50100 PRINT#9,N:REM MAX VALUE OF Y
2F  50110 PRINT#9,M1%:REMSAVES RESET VALUE OF M% WILL BE READ IN AS M%
F4  50120 FOR X=1TOM
9C  50130 FOR Y=1TON
45  50140 GOSUB*****:REM CALL READ SUBROUTINE
04  50150 IFB$="-"THEN50190:REM IGNORES BLANKS NOT NEEDED IN DISK FILE
A0  50160 PRINT#9,X
CB  50170 PRINT#9,Y
C3  50180 PRINT#9,B$
A9  50190 NEXTY
B6  50200 NEXTX
D3  50210 CLOSE9:RETURN
9E  50220 REM ****** READ RECORDS FROM DISK *********
7E  50230 SYS49164:REM RE-INITIALIZE MC READY TO WRITE NEW ARRAY DATA FROM DISK
66  50240 PRINT:PRINT"[SPC5,RVSON,SPC5]LOADING FILE[SPC5,RVSOFF]"
F7  50250 OPEN8,8,8,"FILENAME,S,R"
45  50260 INPUT#8,M
40  50270 INPUT#8,N
8D  50280 INPUT#8,M%:M1%=M%:M%=0
1E  50290 INPUT#8,X
29  50300 INPUT#8,Y
28  50310 INPUT#8,B$:GOSUB*****:REM CALLWRITE SUBROUTINE WILL RECREATE VALUE OF M%
76  50320 IFM%<M1%THEN50290:REM CHECK LENGTH OF FILE
9A  50330 CLOSE8:RETURN
```

Change Size of Buffer

Since the Buffer store is located after the operative, M/c and before the start of the index array, all that's needed to increase/decrease the size of the Buffer is to raise or lower the start of the Index array – i.e. address of START1. This is easy if you're working from the Source Code via an Assembler, otherwise POKE the revised address Lo/Hi bytes into $C022, C024 and $C0AD, C0AF.

Use RAM under Basic Rom

This depends on exactly what you want. Replacing the use of the RAM under the Kernal ROM by that under the BASIC ROM only involves a change of address of START2 to $A000 and a change of ROM/RAM switching code, see below.

If however, you want to use BOTH RAMS giving 16k of array string store, then proceed as follows:

1. Duplicate the M/C commencing at a revised address further up the $C000-A000 memory space, not forgetting to change the Index Array start address (to an apropiate value) and string store START2 address to $A000.
2. Change the ROM/RAM switching codes in lines 660/1440 to %00110110 (54 Dec ie. Basic Rom out) the

Figure 4

```
AC   100 REM ***TEST PROGRAM RO/RA ARRAY STORAGE ****
0D   110 REM START2 SET TO $E000(KERNAL ROM)
B0   120 REM INDEX ARRAY(START1)SET TO C150
4A   130 GOSUB1010:SYS49164:M=0:M%=0:M1%=0:N=0:AM%=0:REM LOAD MC AND INITIALIZE****
32   140 REM ******** WRITE ************
DA   150 PRINT"[CLR]":GOTO250
EA   160 PRINT"[CLR]"
D4   170 PRINT:PRINT"[SPC6]WRITE SEQUENCE"
CC   180 PRINT:PRINT"  INPUT REC NO & COL NO SEPARATED BY[SPC8]A COMMA":INPUTX,Y
0B   190 PRINT:PRINT"  RECORD NO "X","Y"
07   200 IFX>MTHENM=X
4F   210 IFY>NTHENN=Y
68   220 PRINT:PRINT"  INPUT STRING":INPUTB$
F2   230 IFLEN(B$)>20THENGOSUB980:GOTO220
B2   240 GOSUB760
B7   250 PRINT:PRINT" PRESS W FOR WRITE,R TO READ,A TO AMEND, D FOR DISK FUNCTIONS"
94   260 GETA$:IFA$=""THEN260
26   270 IFA$="W"THEN160
F8   280 IFA$="R"THEN330
B9   290 IFA$="A"THEN390
E7   300 IFA$="D"THEN1060
F6   310 GOTO260
58   320 REM ******** READ ***************
89   330 PRINT"[CLR]"
C0   340 PRINT:PRINT"[SPC5]READ SEQUENCE "
EF   350 PRINT:PRINT"  INPUT REC NO & COL NO SEPARATED BY[SPC8]A COMMA":INPUTX,Y
8F   360 GOSUB840:PRINT:PRINT" STRING IS -: ";B$
49   370 GOTO250
DB   380 REM ******** AMEND ***************
F5   390 PRINT"[CLR]"
AF   400 PRINT:PRINT"[SPC6]AMEND SEQUENCE"
43   410 PRINT:PRINT"  INPUT REC NO & COL NO SEPARATED BY[SPC8]A COMMA":INPUTX,Y
95   420 PRINT:PRINT" RECORD NO ";X",";Y
35   430 PRINT:PRINT"  INPUT STRING":INPUTZ$
7E   440 IF LEN(Z$)>20THENGOSUB980:GOTO430
EE   450 GOSUB880
73   460 GOTO250
9F   470 REM ****** WRITE RECORDS TO DISK ******
C3   480 PRINT:PRINT"[SPC5,RVSON,SPC6]SAVING FILE[SPC6,RVSOFF]"
8C   490 M1%=M%-AM%:REM RESET VALUE OF M% READY FOR THE NEXT READ
6D   500 OPEN9,8,9,A$
5E   510 PRINT#9,M:REM MAX VALUE OF X
DB   520 PRINT#9,N:REM MAX VALUE OF Y
42   530 PRINT#9,M1%:REMSAVES RESET VALUE OF M% WILL BE READ IN AS M%
01   540 FOR X=1TOM
59   550 FOR Y=1TON
42   560 GOSUB840:REM CALL READ SUBROUTINE
43   570 IFB$="-"THEN610:REM IGNORES BLANKS NOT NEEDED IN DISK FILE
93   580 PRINT#9,X
86   590 PRINT#9,Y
3D   600 PRINT#9,B$
3F   610 NEXTY
44   620 NEXTX
B9   630 CLOSE9:RETURN
70   640 REM ****** READ RECORDS FROM DISK *********
94   650 SYS49164:REM RE-INITIALIZE MC READY TO WRITE NEW ARRAY DATA FROM DISK
F4   660 PRINT:PRINT"[SPC5,RVSON,SPC5]LOADING FILE[SPC5,RVSOFF]"
38   670 OPEN8,8,8,A$
97   680 INPUT#8,M
92   690 INPUT#8,N
C3   700 INPUT#8,M%:M1%=M%:M%=0
00   710 INPUT#8,X
FB   720 INPUT#8,Y
5F   730 INPUT#8,B$:GOSUB760:REM CALLWRITE SUBROUTINE THIS WILL RECREATE VALUE OF M%
6C   740 IFM%<M1%THEN710
40   750 CLOSE8:RETURN
9A   760 REM *** WRITE TO KROM/RAM STORE *****
CC   770 IFB$="-"ORB$=""THENRETURN
80   780 M%=M%+1
B9   790 HB%=M%/256:LB%=M%-(HB%*256)
F6   800 C=LEN(B$)
84   810 POKE49153,X:POKE49154,Y:POKE49152,C:POKE49159,LB%:POKE49160,HB%
C0   820 FORI=1TOC:POKE49441+I,ASC(MID$(B$,I,1)):NEXTI
30   830 SYS49185:RETURN
77   840 REM ***** READ FROM KROM/RAM STORE ******
10   850 POKE49153,X:POKE49154,Y:SYS49295
0D   860 C=PEEK(49152):B$="":B1$=""
34   870 FORI=1TOC:Z=PEEK(49441+I):B1$=CHR$(Z):B$=B$+B1$:NEXTI:RETURN
A0   880 REM ***** AMEND KROM/RAM STORE ******
0F   890 IFZ$=""THENRETURN
73   900 GOSUB840:IFB$="-"ANDZ$="-"THENRETURN
1D   910 IFB$="-"THENB$=Z$:M%=M%+1:GOSUB760:Z$="":RETURN
25   920 B$=Z$:AM%=AM%+1:M%=M%+1
A3   930 POKE49153,X:POKE49154,Y:POKE49163,55:C=LEN(B$):POKE49152,C
F7   940 HB%=M%/256:LB%=M%-(HB%*256)
1B   950 POKE49159,LB%:POKE49160,HB%
E3   960 FORI=1TOC:POKE49441+I,ASC(MID$(B$,I,1)):NEXTI:SYS49295
E0   970 POKE49163,0:IFZ$="-"THENM%=M%-1
CF   980 Z$="":RETURN
69   990 REM ******** ERROR MESSAGE ********
EA   1000 PRINT:PRINT"[SPC5]STRING TOO LONG PLEASE RE-ENTER":RETURN
1D   1010 REM **** MC LOADER KROM/RAM STOR ****
3D   1020 PRINT"[CLR]"
D0   1030 PRINT:PRINT"[SPC5,RVSON,SPC5]MC FILE LOADING[SPC5,RVSOFF]"
84   1040 OPEN8,8,8,"MC-KROM/RAM STOR,S,R":INPUT#8,SA,EA:IFSTTHENCLOSE8:RETURN
39   1050 FORI=SATOEA:INPUT#8,T:POKEI,T:NEXTI:CLOSE8:RETURN
29   1060 REM ********** LOADING & SAVING ARRAY FILES TO DISK ***********
E0   1070 PRINT"[CLR]":PRINT:PRINT"  INPUT L TO LOAD, S TO SAVE"
3A   1080 GETA$:IFA$=""THEN1080
9E   1090 IFA$="S"THEN1120
5E   1100 IFA$="L"THEN1130
63   1110 GOT1070
5A   1120 INPUT" ENTER FILENAME";A$:A$=A$+",S,W":GOSUB470:GOTO1140:REM SAVING FILE
27   1130 INPUT" ENTER FILENAME";A$:A$=A$+",S,R":GOSUB640:REM LOADING FILE
46   1140 GOTO250
02   1150 END
```

switching in codes do not need any change.

3. Duplicate the Basic subroutines, but include the changed SYS calls. There is no need to change the Basic variableble name unless your program requires it.

Handling Several Arrays

The Kram and/or the Basic Ram space gives one or two large arrays, to provide more you can either replicate the M/C, Index, arrays and communicating Basic, a set for each array (this seems to be poor memory usage to me), or preferably store all arrays within the one or two large ones by juggling the array references.

The first option uses up memory in duplicated M/c coding, takes longer to load in etc. In each large Kram or Basic ram array X and Y can both take any value between 1 and 255.

Thus if for example you want as extra arrays C$, 50, 50 D$, 50 50 and E$, 50, 50, then these can be stored as three apparently separate arrays in the larger array space since X and Y be changed for each by some simple Basic lines.

So with a few filtering lines of Basic added to each of the Write, Read and Amend communicating coding (assuming B$ is the common array reference) eg:.

```
IF D$=B$ THEN
X=X+50: Y=Y+50: GOSUB***:
D$=B$: X=X-50: Y=Y-50: RETURN

IF E$=B$ THEN
X=X+100: Y=Y+100: GOSUB***:
E$=B$: X=X-100: Y=Y-100: RETURN
```

Where GOSUB*** takes the program to what would be the normal Communicating Basic start line for Write, Read and Amend coding, we can now access three different arrays. Obviously there is insufficient memory space to use every X, Y combination, but after all you can't use A$(100,100) to hold much in the standard Basic arrays!

Conclusion

So there you are. Memory usage is entirely in your own hands! The M/C won't give any out of memory messages: it will just plough on regardless. However, by arranging for your Basic program to sum string lengths and count-up Index array usage (5*M%bytes), you can easily provide your own warnings.

You must include some control to limit each string's input length (together with an apropiate error message) otherwise you could overflow the Buffer and start to overwrite the Index array record (Disaster! Program crash at next Read).

Fig. 4 gives a Basic test program for you to try out to get the feel of the scheme (including a Sequential file M/C loader). Figs 5 &6 gives the M/C's in DATA form for both Kernal/Ram and Basic/Ram storage the Basic/Ram code being set to co-exist with the Kernal/Ram store, thus realizing the maximum storage available.

Figure 5

```
KERNAL RAM ARRAY STORAGE

100 FOR I= 49152  TO 49462  : READ A : POKE I,A: NEXT I
110  DATA     0, 0, 0, 0, 0, 0, 0, 0,
120  DATA     0, 0, 0, 0, 169, 80, 160, 193,
130  DATA     141, 3, 192, 140, 4, 192, 169, 0,
140  DATA     160, 224, 141, 5, 192, 140, 6, 192,
150  DATA     96, 173, 3, 192, 172, 4, 192, 133,
160  DATA     251, 132, 252, 160, 0, 173, 0, 192,
170  DATA     145, 251, 173, 1, 192, 200, 145, 251,
180  DATA     173, 2, 192, 200, 145, 251, 173, 5,
190  DATA     192, 200, 145, 251, 173, 6, 192, 200,
200  DATA     145, 251, 24, 173, 3, 192, 105, 5,
210  DATA     141, 3, 192, 169, 0, 109, 4, 192,
220  DATA     141, 4, 192, 173, 5, 192, 172, 6,
230  DATA     192, 133, 251, 132, 252, 120, 169, 53,
240  DATA     133, 1, 160, 0, 185, 34, 193, 145,
250  DATA     251, 200, 204, 0, 192, 144, 245, 169,
260  DATA     55, 133, 1, 88, 24, 173, 5, 192,
270  DATA     109, 0, 192, 141, 5, 192, 169, 0,
280  DATA     109, 6, 192, 141, 6, 192, 96, 160,
290  DATA     0, 140, 9, 192, 140, 10, 192, 162,
300  DATA     80, 160, 193, 134, 251, 132, 252, 160,
310  DATA     1, 173, 1, 192, 209, 251, 208, 9,
320  DATA     160, 2, 173, 2, 192, 209, 251, 240,
330  DATA     49, 24, 165, 251, 105, 5, 133, 251,
340  DATA     169, 0, 101, 252, 133, 252, 172, 9,
350  DATA     192, 200, 208, 3, 238, 10, 192, 140,
360  DATA     9, 192, 204, 7, 192, 144, 208, 172,
370  DATA     10, 192, 204, 8, 192, 144, 200, 169,
380  DATA     1, 141, 0, 192, 169, 45, 141, 34,
390  DATA     193, 96, 174, 11, 192, 224, 55, 240,
400  DATA     42, 160, 0, 177, 251, 141, 0, 192,
410  DATA     160, 4, 177, 251, 133, 254, 136, 177,
420  DATA     251, 133, 253, 120, 169, 53, 133, 1,
430  DATA     160, 0, 177, 253, 153, 34, 193, 200,
440  DATA     204, 0, 192, 144, 245, 169, 55, 133,
450  DATA     1, 88, 96, 169, 0, 160, 0, 145,
460  DATA     251, 200, 145, 251, 200, 145, 251, 76,
470  DATA     33, 192, 0, 0, 0, 0, 0, 0,
480  DATA     0, 0, 0, 0, 0, 0, 0, 0,
490  DATA     0, 0, 0, 0, 0, 0,

INITIALIZE SYS49164 WRITE SYS49185 READ SYS49295 BUFF 49442

LEN 49152 RECNO 49153 COL 49154 MAXREC 49159-49160 AMND 49163
```

Figure 6

```
BASIC RAM ARRAY STORAGE

100 FOR I= 51536  TO 51846  : READ A : POKE I,A: NEXT I
110  DATA     0, 0, 0, 0, 0, 0, 0, 0,
120  DATA     0, 0, 0, 0, 169, 160, 160, 202,
130  DATA     141, 83, 201, 140, 84, 201, 169, 0,
140  DATA     160, 160, 141, 85, 201, 140, 86, 201,
150  DATA     96, 173, 83, 201, 172, 84, 201, 133,
160  DATA     251, 132, 252, 160, 0, 173, 80, 201,
170  DATA     145, 251, 173, 81, 201, 200, 145, 251,
180  DATA     173, 82, 201, 200, 145, 251, 173, 85,
190  DATA     201, 200, 145, 251, 173, 86, 201, 200,
200  DATA     145, 251, 24, 173, 83, 201, 105, 5,
210  DATA     141, 83, 201, 169, 0, 109, 84, 201,
220  DATA     141, 84, 201, 173, 85, 201, 172, 86,
230  DATA     201, 133, 251, 132, 252, 120, 169, 54,
240  DATA     133, 1, 160, 0, 185, 114, 202, 145,
250  DATA     251, 200, 204, 80, 201, 144, 245, 169,
260  DATA     55, 133, 1, 88, 24, 173, 85, 201,
270  DATA     109, 80, 201, 141, 85, 201, 169, 0,
280  DATA     109, 86, 201, 141, 86, 201, 96, 160,
290  DATA     0, 140, 89, 201, 140, 90, 201, 162,
300  DATA     160, 160, 202, 134, 251, 132, 252, 160,
310  DATA     1, 173, 81, 201, 209, 251, 208, 9,
320  DATA     160, 2, 173, 82, 201, 209, 251, 240,
330  DATA     49, 24, 165, 251, 105, 5, 133, 251,
340  DATA     169, 0, 101, 252, 133, 252, 172, 89,
350  DATA     201, 200, 208, 3, 238, 90, 201, 140,
360  DATA     89, 201, 204, 87, 201, 144, 208, 172,
370  DATA     90, 201, 204, 88, 201, 144, 200, 169,
380  DATA     1, 141, 80, 201, 169, 45, 141, 114,
390  DATA     202, 96, 174, 91, 201, 224, 55, 240,
400  DATA     42, 160, 0, 177, 251, 141, 80, 201,
410  DATA     160, 4, 177, 251, 133, 254, 136, 177,
420  DATA     251, 133, 253, 120, 169, 54, 133, 1,
430  DATA     160, 0, 177, 253, 153, 114, 202, 200,
440  DATA     204, 80, 201, 144, 245, 169, 55, 133,
450  DATA     1, 88, 96, 169, 0, 160, 0, 145,
460  DATA     251, 200, 145, 251, 200, 145, 251, 76,
470  DATA     113, 201, 0, 0, 0, 0, 0, 0,
480  DATA     0, 0, 0, 0, 0, 0, 0, 0,
490  DATA     0, 0, 0, 0, 0, 0,

INITIALIZE SYS51548 WRITE SYS51569 READ SYS51679 BUFF 51826

LEN 51536 RECNO 51537 COL 51538 MAXREC 51543-51544 AMND 51547

INDEX STORE $CAA0 (51872) UPWARDS

STRING STORE $A000 (40960) TO $C000 (49152)
```

Memory Mapping

Modelling the memory without warping your mind.

When you buy your first Commodore 64 computer, the first thing that hits you is the fact that you don't have 64K of memory at your disposal. The second surprise is that the computer has in fact 88K of memory and not 64.

How is this possible, you ask yourself, especially when the address bus is only 16 bits long? The secret is in the design of the 6510 processor chip, and the design of the RAM/ROM areas themselves. Before we get into technical detail on how to juggle memory around, we should take a look at Figure 1.

This is how your computer's memory looks on power-up. We call this the 'Memory Map'. The memory of the Commodore 64 can be set to 8 different maps. What these maps provide, and how to obtain them, will be explained later. For now refer back to Figure 1.

As you can see, the map is split up into areas. We call these areas Zones. Each zone starts and ends at specific address locations within the memory. From 0000-9FFF hex (0-40959 decimal), we have Ram. From A000-BFFF hex (40960-49151 decimal), we have Basic Rom. From C000-CFFF hex (49152-53247 decimal), we have more Ram. From D000-DFFF hex (53248-57343) we get more Rom and finally from E000-FFFF hex (57344-65535 decimal) we have the Kernal Rom.

However, three of these zones have two lots of memory occupying the same space. This second memory area is known as the 'Shadow' or 'Hidden' Ram. The areas in question are A000-BFFF, D000-DFFF and E000-FFFF. This then is how the 64 manages to squeeze not 64K but 88K of memory into its little size.

So just what exactly have you got available to yourself on intitial power up? Figure 2 shows a broken-down version of Figure 1. This is the default memory map, as you can see from the diagram.

Provided you are only writing short, no-nonsense basic programs, this memory is quite adequate. However, the time will come when you'll want to expand your programming techniques. This will entail redefining the character set using user-designed screens, and perhaps adding music and scroll routines, or writing your own basic command words. The list is endless.

Now it becomes all too apparent that this memory is not enough. Somehow, you must juggle around with memory to get the extra you require. Before you can do this though, you'll need to know something about the 6510 processor chip, and memory locations 0000 and 0001.

Residing on the chip is an Input/

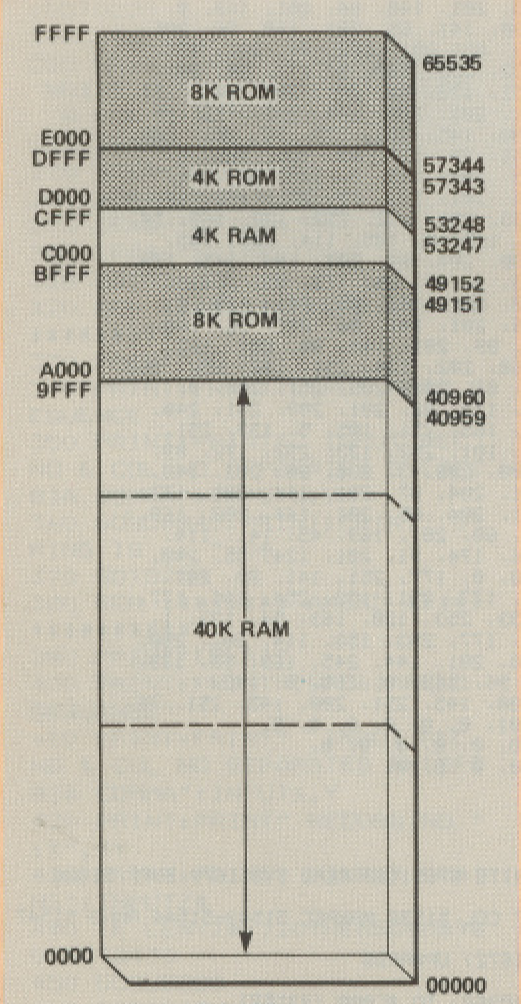


FIGURE 1

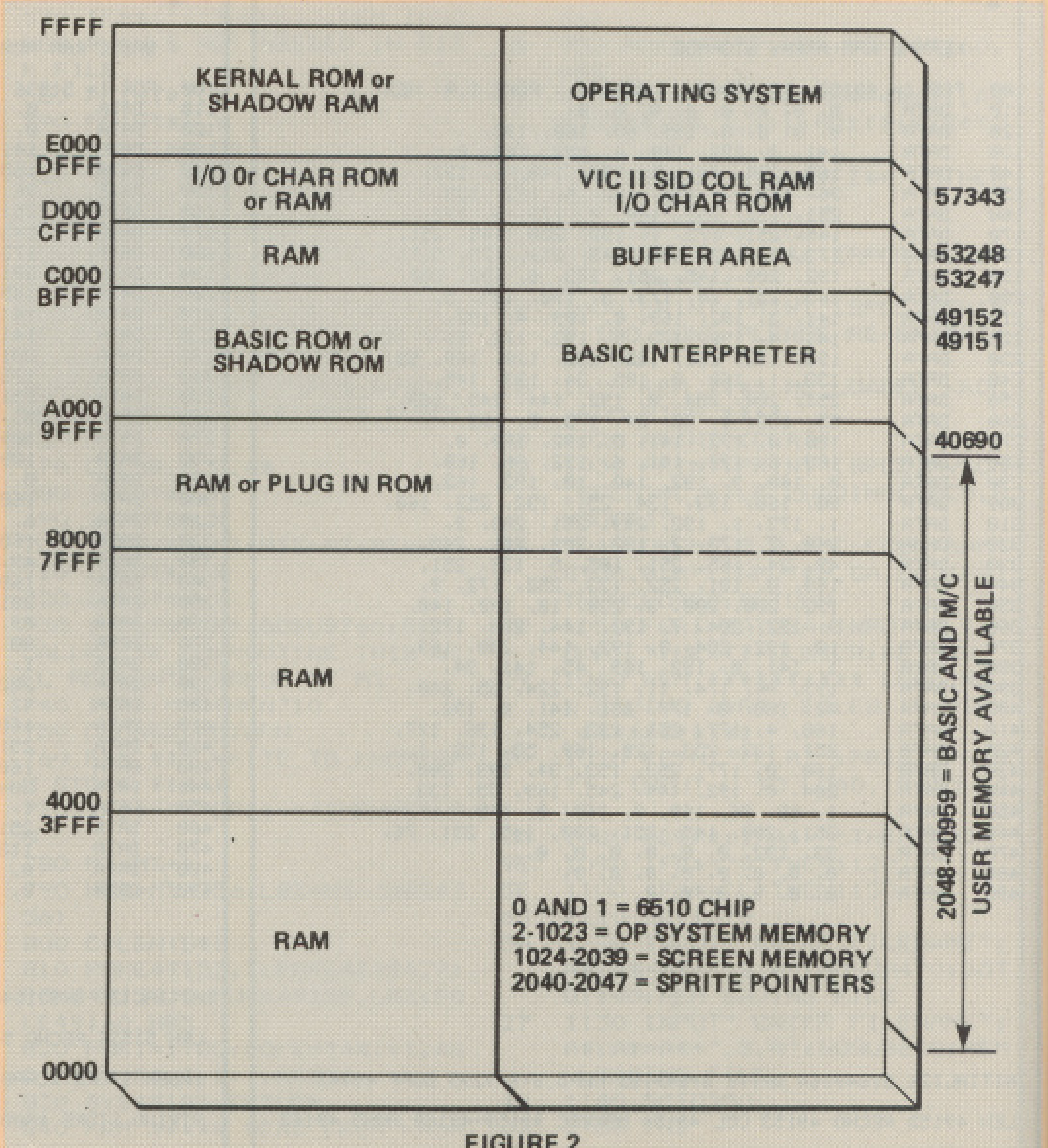


FIGURE 2

Output port that's responsible for telling the computer where Ram/Rom and Input/Output will appear within the computer's memory. A word of caution: this port also controls the cassette deck operations, so be careful, especially if you are not a drive user.

The port for the chip appears at address 0001 of the memory map, the Data Direction Register for the port at memory location 0000. Like all other ports of the system, this 6510 port is controlled by the Data Direction Register (known as the DDR). The DDR controls whether a given bit will be set for input or output. The actual transfer however, is carried out through the chip port.

If all this seems too complex to follow, look at figure 3. This should help to make things a little clearer. The default values for the DDR are shown in Figure 4. The 1's signify an output and the 0's an input. Judicious tinkering with these control bits allows us to juggle around with memory.

Before showing the eight different memory configurations available, a little more technical information is required. If you look at Figure 3 again, you'll notice CHAREN, LORAM and HIRAM. For those of you who don't know what these words mean here's an explanation:

TITLE	BIT POSITION	DIRECTION	BRIEF DESCRIPTION
LORAM	0	OUTPUT	CONTROLS RAM/ROM AT 0000-BFFF
HIRAM	1	OUTPUT	CONTROLS RAM/ROM AT E000-FFF
CHAREN	2	OUTPUT	CONTROLS ROM/I/O/RAM AT D000-DFFF
	3		DATASETTE WRITE SWITCH
	4	INPUT	DATASETTE SWITCH SENSE
	5	OUTPUT	DATASETTE MOTOR CONTROL

FIGURE 3

BIT No.	5	4	3	2	1	0
SET TO VALUE	1	0	1	1	1	1

NOTE: 1 = OUTPUT 0 = INPUT

FIGURE 4

CHAREN, which as you can see is controlled by bit 2, can be thought of as short for Character generator. Its sole purpose is to either bank in or bank out the 4K of character Rom. As far as your processor is concerned, the character generator sits at the same address space as the input/output devices. When the line is set to a 1, the I/O devices are banked in, and the character Rom is not accessible (this is the normal state of affairs). When the line is set to 0, the character Rom is banked in, and the I/O devices out (the processor only needs to access the Rom when downloading the character set into Ram). The Charen line can be overidden by certain other control lines in other memory configurations.

HIRAM is controlled by bit 1, and controls the operation of the Kernal Rom. If the line is set with a 1, the Kernal Rom appears in the processor space. By setting the line to 0, we can access the Ram underneath. This is an ideal place for storing screen data or music data.

LORAM controls the area of memory containing the Basic Rom. Set the line to 1, and you have access to the Rom. Set the line to 0, and you bank out the Rom and gain access to the Ram. Once again, this is an ideal place for storing data or text. Quickly referring back to Figure 1 again, you'll see that there are a total of three of these 'Shadow Ram' areas. If we write or poke to the Rom, the values we're writing will be stored in these Shadow Ram areas. If we read or peek however, the values returned are the Rom values, and not the Shadow Ram ones.

BREAKDOWN OF MEMORY FROM SD000-SDFFF

SD000-SD3FF(D02E) 53248-53294	VIC CHIP -(VIDEO CONTROLLER)	1K
$D400-$D7FF 54272-55295	SID CHIP -(SOUND GENERATOR)	1K
$D800-$DBFF 55296-56319	COLOUR MEMORY	1K
$DC00-$DCFF 56320-56575	CIA1 -(KEYBOARD)	¼K
$DD00-$DDFF 56576-56831	CIA2 -(SERIAL/USER PORT/RS232)	¼K
$DE00-$DEFF 56832-57087	OPEN I/O SLOT 1 (CP/M)	¼K
$DF00-$DFFF 57088-57343	OPEN I/O SLOT 2 (DISK)	¼K

FIGURE 5

I've mentioned the Input/Output devices. So just what are they? If you look at Figure 5, this gives you the breakdown of the 4K of memory from $D000-$DFFF, which is the I/O area.

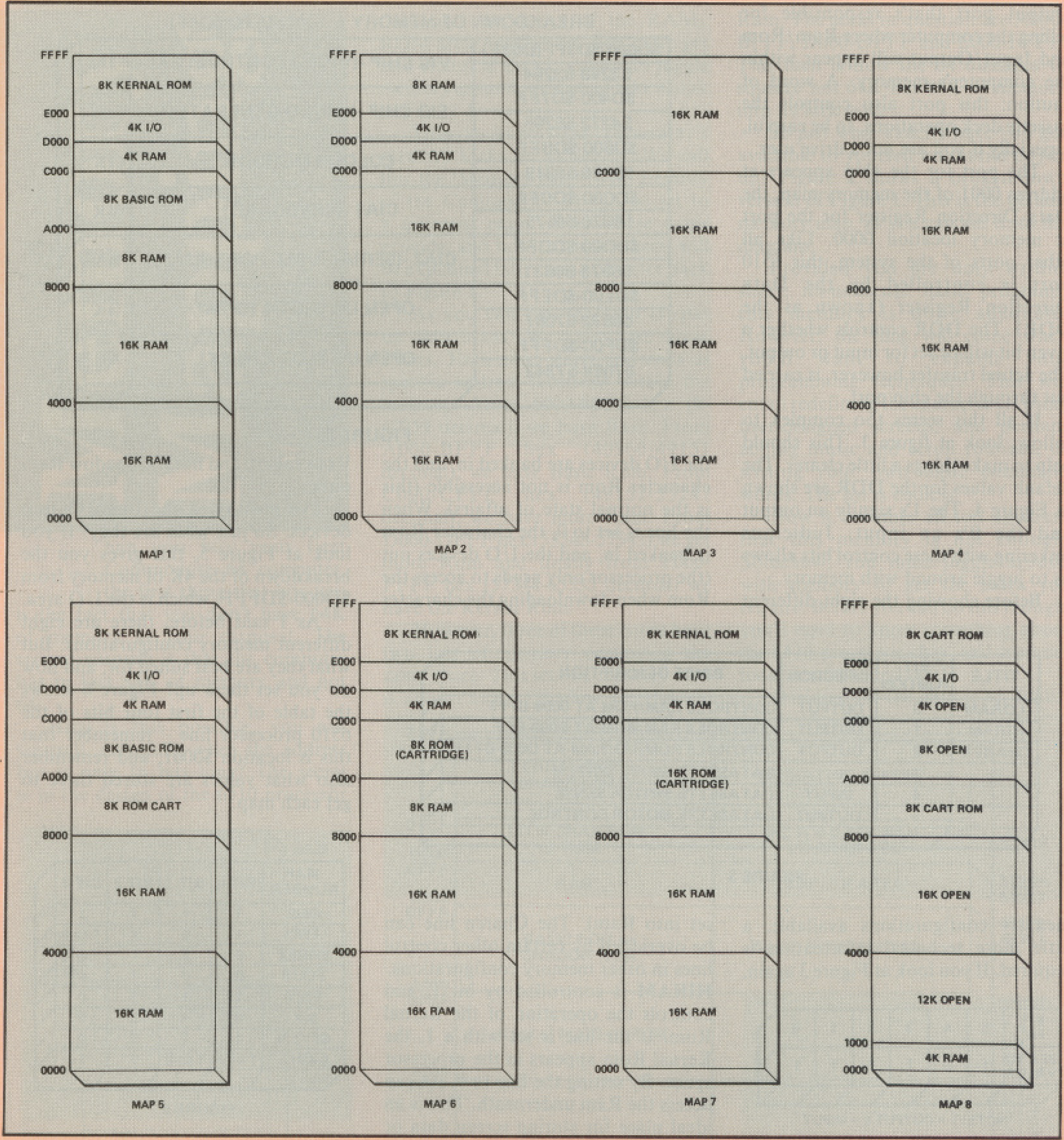
As I said before, there are eight different memory configurations. But what they are best suited for, and how do you set them up? Figure 6 shows the table of the first four bits of the 6510 processor line – remember that this is location $0001, and remember also what values are stored there to get each map.

MAP NUMBER	BIT 0	BIT 1	BIT 2	BIT 3
ONE	1	1	1	1
TWO	1	0	1	1 or 0
THREE	0	1	1	1 or 0
FOUR	0	0	1	0
FIVE	1	1	1	0
SIX	0	1	0	0
SEVEN	1	1	0	0
EIGHT	1 or 0	1 or 0	0	1

FIGURE 6

Map 1 gives you the default setting. In this setting you have Basic 2.0, and 38K of user Ram. Map 2 allows you 60K of Ram, and the I/O devices. However, the user will have to write hiw own driver routines for any input/output operations.

Map 3 is rather an interesting one. You are provided with the I/O devices, Kernal Rom and 52K of Ram. This set-up is best suited for CP/M operations. Map 4 allows for all 64K of Ram. However, for any input/output activity, the Rom at $D000-$DFFF must be banked in again. Map



5 is the standard configuration when using an expansion cartridge, and it's ideal also for writing your own extensions to Basic.

Map 6 gives us 40K of Ram, plus an extra 8K of plug-in Rom for applications that don't require Basic. Map 7 allows us 32K of user Ram and 16K of plug-in Rom. Once again, this is ideal for applications that don't require the use of Basic. Finally, Map 8 is what's known as the 'Ultimax Video Game' map (I've never actually come across this set-up).

That more or less concludes our tour around memory – I hope that things are a little clearer by now. Try experimenting yourselves (you won't harm the computer – lock it up if you need to). There follows a short example of putting some of this knowledge into use. Suppose you've written a short extended basic program. Underneath Basic Rom, you will probably have put some of the essential data (data for F-key redifinition).

However, at some stage you'll want to read the directory of a disk. To do this you will need the Rom banked in. Therefore, your coding may look something similar to this:-

```
LDA $01
ORA # $01
STA $01
read directory
LDA $01
AND # $FE
STA $01
return
```

This is only a very simplified example – I'll leave the rest to your imagination.

News Maker 128



Can you really use a C128 for desk-top publishing?

***Gordon Davis** investigates News Maker 128*

DTP programs for the C128 are uncommon animals. This means that the 128 is not the prime choice for a prospective publisher – anyone with serious magazine requirements will look at a Mac, or at least an Amiga. There must be a fair number of C128 owners, however, who would welcome the chance to try their hands at DTP, particularly when it comes to producing small newsletters and things of that sort.

News Maker 128 seems to be aimed at this sort of market area. It's produced by Free Spirit, a Californian software house which also turned out Sketchpad 128, a graphics package which is also compatible with News Maker. Like Sketchpad, News Maker is written in Basic 8. This is an advanced, graphics-orientated Basic for the C128 published by Walrusoft last year.

Hardware requirements

Again like Sketchpad, News Maker requires the use of a Commodore 1351 mouse or a similar type, so purchasers will have to take this into account as a possible hidden cost. Apart from this, it will work with a standard C128D, but C128 owners will have to have the 64K Video Ram chips installed.

To those unfamiliar with DTP, this is basically a matter of page layout. Like most such packages, News Maker will allow you to place both text and graphics in a multi-column format on an image of a printed page. Five preset page formats are supported. The standard one is three columns with a header area which spreads all the way across the page. This is where you would put the title of your publication, plus possibly a major headline. Two, four column and other layouts are also available.

Written words

Before you can get started knocking out your page, you'll need raw material. Text can be produced for the program by using an associated package on the same disk called Note Pad. Note Pad is a base-level wordprocessor with almost no features to speak of.

It would have been helpful if Free Spirit had specified alternative wordprocessors whose files were compatible with News Maker. I'm sure there are some, but users will have to figure that out for themselves.

Once your text files have been prepared, you can 'pour' them into the columns in News Maker. This simply makes the text conform to a given rectangular area. Of course, some control over text size and style is essential to any DTP package, and News Maker is no exception. A number of fonts are available on disk, and text can be displayed in any of these over a number of different typesizes.

Is it art?

The other essential element we need on a page is graphics. The manual is more forthcoming about this. Art can be imported into News Maker from any other Basic 8 or graphics package. In practice, this cuts the possibilities down a lot, since the only two I can think of are Sketchpad 128, Free Spirit's own, and the Graphics demo on the Basic 8 program disk itself.

Be that as it may, Clip art, known by the program as a 'brush' file, can be loaded from disk and dumped into a rectangular area, just like text. Of course, that isn't quite enough to produce a professional-looking page. The user will need to modify the graphics and add extra elements such as lines and blocks to the screen.

Modifications to the pictures are quite basic. They can be reversed, flipped or mirrored, besides of course being cropped for size. Besides this, you can also use art tools to draw lines, boxes and circles wherever you wish on the screen.

The thickness of any of these in pixels can also be specified, and can be anything from one to nine. You can also draw graphics freehand, although I would not especially recommend this. A useful zoom feature also allows you to adjust individual pixels, and needless to say you can also erase areas of the page.

That's about the size of it. News Maker is not the most cosmic program I've ever seen, but it doesn't have much competition in its area. Provided you don't want to do anything too advanced, it may well meet your needs, particularly for small requirements like newsletters.

But beware of hidden costs. Besides the 1351 mouse, plus video Ram for C128, as opposed to C128D users, you will really need a copy of Sketchpad 128, from the same authors. News Maker, by the way, suffers from the same unappealing documentation as the other program.

Touchline:
***Title:** News Maker 128. **Supplier:** FSSL, 18 High Street, Pershore, Worcestershire, WR10 1BG. **Tel:** (0386) 553153. **Price:** £34.95.*

Tech Troubles

A crop of problems from the postbag ably answered by our agony uncle, Andy Andros



I've been thinking of getting a printer for my C128D but all this talk about RS232, Centronics and serial interfaces totally confuses me. Can you tell me what the differences are and why Centronics interfaces seem to be either very cheap or incredibly expensive?
Sid Knowles, Bodmin, Cornwall

Dear Sid,
It's no wonder you're confused, because I could write a hefty tome about printers and interfaces. Basically, there are three types of printers available for the C128 and the other eight bit Commodore machines. Since you are asking about interfaces, I will presume that you've decided that the Commodore printers don't fit your needs. This means we are left with Centronics and RS232 machines.

All types of printers do roughly the same job, it's just the extra facilities that differ from manufacturer to manufacturer and the way in which the information is passed from the computer to the printer. RS232 and Centronics are the names of two different methods of transmitting data.

RS232 is a general purpose interface which is designed so that the computer can send and receive data. This interface is used for applications such as modem linking and peripheral control systems. A printer falls into this latter category but in my opinion an RS232 link is wasted on most printers. A printer doesn't need sophisticated communications because its vocabulary only consists of *feed me some data* and *busy – please wait*. My main criticism of RS232 is that the computer will need an RS232 interface plus driver software. The software is the real problem because although many commercial software packages contain an RS232 driver, an awful lot don't and it is usually impossible to patch your own driver into the system because of software protection tricks.

The driver program serves two purposes. Firstly, it sets up the correct communications link (protocol) so that the printer receives the data in a particular form. Secondly, it acts as a translator because Commodore don't use standard ASCII characters but printers do (except Commodore's own, of course). You may have used Commodore's ASCII codes, these are the numbers allocated to letters, number characters and the graphics shapes that are produced using the SHIFT and CBM keys. For example, when the Commodore is in the mode that allows upper and lower case together, a lower case 'a' is allocated the decimal value of 65 and a capital 'A' is CHR$ 97. In true ASCII the opposite rule applies and 'A' is 65 but 'a' is 97. This is only one of the problems and when the graphics characters are considered the situation becomes extremely complicated.

My advice is to forget about RS232 and concentrate on Centronics interfacing because the majority of manufacturers favour this system and interfacing is much simpler.

A basic Centronics interface consists of a lead which connects directly into the printer from the computer's user port. Once again a

translation program is needed and this carries the same warning that I gave about RS232 drivers – it won't work in every situation. As you correctly point out, the price range can be confusing until you realise that Centronics interfaces come in two forms: the basic lead that costs around £10 including software, and the Centronics interface modules that start around £30 but can cost as much as £80 plus.

The interface module has several advantages but the main one is that it connects to the serial port, leaving the user port free for other applications. The reason that this is possible is that the module does the job of translating Commodore ASCII into standard ASCII and that means that driver software is unnecessary. Many interfaces can be switched so that the computer thinks that it is feeding a Commodore printer while the printer thinks it's found its perfect partner. Consequently, the interface will work with any software and, when the user has mastered the use of the printer in this mode, the interface can be switched to allow access to any advanced features which the printer may possess.

In a nutshell, a Centronics printer with an interface module is the perfect combination for use with the C128, C64, C16 or Plus 4. It may not even add to the cost of the printer because some manufacturers include an integral interface into the cost of the machine but this may mean buying a new interface when upgrading the computer in the future. The risk is whether the interfaces will still be available when upgrade time arrives!

If I was forced to express a printer preference it would be a Citizen 120D (around £160) or a Star Micronics LC10 (around £199) which both have a Commodore interface option. Since I have an unquenchable distrust of hardware availability, I would go for the Centronics versions of these machines and add an interface to the cost (call it insurance money, if you like!). At the bottom end of the range there is the Super-G interface (around £35) but the Rolls Royce is the Super Graphix Gold interface (£99.95) with a 32K buffer and graphics facilities which make it worth every penny.

I've recently bought a 1541C disk drive but I can't seem to get the save and replace command to work. My wordprocessor seems to save and replace alright but for some reason whenever I try to do it from Basic it fails. I'm a complete beginner and I want to check that it's not my fault before I return it for repair.
Ken Curtis, Ripon, N Yorks

Dear Ken,
I hesitate to say this but I think the fault lies in your syntax. What you should be typing in is:

SAVE"@0:progname",8

Please check it carefully and let me know if it works before doing anything hasty!

As a beginner, you may not be aware that this command should come with a Government Health Warning. The 1541 is a reasonably good drive but it does have some bad habits where save and replace is concerned. There appears to be a very nasty bug which snarls up the system occasionally when this command is executed. The result is that the newly saved program will load back with no problems but it may have overwritten part of an existing program on the disk. To avoid this I prefer to scratch the program using OPEN15,8,15:PRINT#15, "S0:progname": CLOSE15. Then the program in the computer can be saved with the normal SAVE command.

I got a copy of Activision's Music Studio as a Christmas present but it won't load. Every time I try it crashes out. I have tried taking it back to the shop but the man there tried it on their C64 and it worked perfectly. He said my cassette recorder must be faulty so I went back home and borrowed a friend's but it still wouldn't load even though it loaded on his alright. Is there something wrong with my computer?
Vera Mitchell, Billingham, Cleveland

Dear Vera,
No, if your computer loads everything else without any problems then there can only be one problem – you've got an old C64.

During its lifetime the Commodore 64 has gone through several changes and the earliest Commodore machines sometimes show this kind of incompatibility. I'm afraid that there is no easy answer to your problem and all I can suggest is that you take this reply to the 'man in the shop' and see if you can get your money refunded. If not, send the whole package back to Activision by recorded delivery and I'm sure they'll replace it or refund your money – they're quite helpful like that. Incidentally, the address on the packaging is probably out of date. Their current address is Activision (UK) Ltd, Blake House, Manor Farm Road, Reading, Berks RG2 0JN

I've just bought an Amiga and I got *Defender of the Crown* because my friend has it on his C64 and I like playing it. Was I disappointed! Apart from the superb graphics, the game seems worse than the C64 version! How is this possible? Sometimes I leave some men at my home castle and when I return I find they've been breeding like rabbits while I was away. The C64 soldiers don't seem to be as randy! Why?
Trevor Jones, Stratford, London

Dear Trevor,
Come off it – the Amiga version is still pretty good. I think you're being a little hasty with your comments but I must confess that there are a few bugs (sorry Cinemaware, I mean additional features) in the Amiga version which cause the problem that you've outlined. The reason this is different from the C64 version is that the programmers only realised that there was a problem after the game was released. At that time the C64 version was still in the pipeline and could be 'fixed' before release.

If you have a problem let us know and Andy will try to help. Write to: Tech Troubles, Your Commodore, 1 Golden Square, London W1R 3AB.

Routine Programing

Serve up your menu options without making a hash of it

By Eric Doyle

Menus are often characterised by lots of 'S' and 'Q' symbols, and lashings of text. A simple subroutine can dish out the options without fuss.

A menu page consists of a title and a list of options, with some form of selection system. This subroutine menu displays any title and up to ten options, which can be selected by moving a highlighting bar up and down the screen and then pressing the RETURN key. Each directory entry can have up to 39 characters, and everything is beautifully centred on the screen.

The finished routine is not a fine example of variable usage because all of the assigned letters are the same, 'Z'. This is done to assist with the writing of the master program – as long as variables starting with Z are avoided, the programmer is free to use any variables without regard to any library routines that are to be employed. Debugging is thereby simplified, because the subroutines all work perfectly, and any faults must therefore lie in the master program.

Starters For Ten

The subroutine needs certain variables passing to it so that it can work properly. The menu title is assigned to Z$, and up to ten options of less than 40 characters are each assigned to the array Z$(x), where x is the option number. The total number of options is stored as variable Z. Limiting the options to a maximum of ten means that a DIM command isn't necessary.

The first line of the subroutine calculates the length of the title, and then checks for valid values of Z$ and Z. After the calling program is complete, this IF...THEN trap can be erased.

```
60050 Z2=LEN(Z$):IFZ=0ORZ2>40TH
      ENSTOP
```

The screen is then cleared by the next line, and the title centred by calculating the number of spaces to be left (ZZ). Once this has been done, the text can usually be easily printed on the screen. The only exception occurs when the title occupies all 40 character spaces, because the next program line, which underlines the title, would be forced to print one line lower than desired. To avoid this, the PRINT statement is terminated with a semi-colon, and an extra PRINT command is only executed if the title is less than 40 characters long.

```
60055 PRINT"[CLR]":ZZ=(40-Z2)/2
       :PRINTSPC(ZZ)Z$;:IFZ2<40T
      HENPRINT
```

Using the ZZ value which was set for positioning the title, an underline character is printed to the same length as, and in a similar way to, the title.

```
60060 PRINTSPC(ZZ);:FORZ1=1TOLE
      N(Z$):PRINT"[SE]";:NEXT:I
      FZ2<40THENPRINT
```

The bottom of the screen carries the instructions for using the menu. After the cursor is positioned at a point three lines from the bottom of the screen, the message is printed in reverse characters to make it stand out.

```
60065 PRINT"[HOME,DOWN22,CP40]"
      ;
60070 PRINT"[RVSON] HIGHLIGHT A
      NY OPTION WITH THE CRSR K
      EY ";
60075 PRINT" THEN USE THE <RETU
      RN> KEY TO SELECT IT";:PO
      KE2023,160
```

Without the final command, the whole screen would scroll up as the final space was printed. Poking a value to location 2023 fills the space without invoking the scroll routine.

The Main Course

To allow maximum flexibility, the number of menu options can range from between one and ten entries. This causes the problem of sensibly positioning the options on the screen. The solution is to derive the first line's screen position from the total number of options given in variable Z.

The formula in line 60080 does this, and the following line then prints sufficient cursor downs to locate the cursor on the correct line.

```
60080 ZZ%=7-Z/2:ZZ$="[RIGHT19]"
60085 PRINT"[HOME]":FORZ1=0TOZZ
      %:PRINT"[DOWN]";:NEXT
```

Certain conditions have to be met to actually print the menu on the screen. All of the menu options must be less than 40 characters long, so a trap is included after the length is measured in line 60090. Another problem is centering each option on its line, and this is further complicated because of the decorative means of printing.

Instead of the normal left to right printout, the program reveals each option from the centre of the screen outwards:

```
              H
             THE
             THE
           S THE O
          IS THE OP
        S IS THE OPT
       IS IS THE OPTI
      HIS IS THE OPTIO
     THIS IS THE OPTION
```

This is achieved by applying the MID$ command several times. Every time the MID$ is called, its length is increased by two characters, and the point from which the string is printed is pulled back by one character.

Each option must be dealt with in turn, so the Z1 loop is initiated, the string length calculated and an overlength trap set up. As before, the trap can be removed from the final program.

For the MID$ process to work correctly each string must have an even number of characters. This is ensured by line 60095 by tricking the system into believing that all strings contain an odd number of characters.

The spacing string which would place the full option title centrally on its line is derived from the string ZZ$, which was set up on line 60080.

```
60090 FORZ1=1TOZ:Z$="":Z2=LEN(Z
      $(Z1)):IFZ2>39 THENSTOP
60095 IFZ2/2=INT(Z2/2)THENZ2=Z2
      +1
60100 IFZ2<39THENZ$=LEFT$(ZZ$,(
      41-Z2)/2)
```

Line 60105 sets up a nested loop for spreading the option across the screen using MID$.

```
60105 FORZ3=Z2TO1STEP-2
60110 PRINT"[UP]"Z$;LEFT$(ZZ$,Z
      3/2);
60115 PRINTMID$(Z$(Z1),Z3/2+.5,
      Z2-Z3+1):NEXT
60120 IFZ1<>ZTHENPRINT:PRINT
60125 Z$(Z1)=Z$+Z$(Z1):NEXT
```

Before taking the next option's text via the outer loop, line 60125 modifies Z$(Z1) for use in the option selection process which is to follow.

When all of the options have been displayed and processed, ZZ$ is first modified and used to determine where the first menu option is located on the screen. The option is then reversed out, or highlighted, to indicate the cursor's starting position.

```
60130 ZZ$="[HOME,DOWN21]"
60135 Z1=1:PRINT"[RVSON]"LEFT$(
      ZZ$,ZZ%+2*Z1)Z$(1)
```

The Final Course

Now the program gets down to the main selection routines by detecting a cursor up or down input from the keyboard and jumping to the relevant subroutine. If RETURN is pressed, the current value Z1 is passed to variable Z and control returns to the main program.

```
60140 GETZ1$:IFZ1$="[UP]"THENGO
      SUB60160
60145 IFZ1$="[DOWN]"THENGOSUB60
      180
60150 IFZ1$=CHR$(13)THENZ=Z1:RE
      TURN
60155 GOTO60140
```

The only thing that the cursor up subroutine needs to look out for is when it reaches the topmost option. In this case, the value of Z1 is increased to equal the last option's value. Otherwise the current line is de-highlighted and the line above it is highlighted.

```
60160 PRINTLEFT$(ZZ$,ZZ%+2*Z1)Z
      $(Z1)
60165 Z1=Z1-1:IFZ1=0THENZ1=Z
60170 PRINT"[RVSON]"LEFT$(ZZ$,Z
      Z%+2*Z1)Z$(Z1)
60175 RETURN
```

Similarly, the cursor down routine acts as would be expected, unless it is on the last menu entry from which it cycles up to the first option again.

```
60180 PRINTLEFT$(ZZ$,ZZ%+2*Z1)Z
      $(Z1)
60185 Z1=Z1+1:IFZ1=Z+1THENZ1=1
60190 PRINT"[RVSON]"LEFT$(ZZ$,Z
      Z%+2*Z1)Z$(Z1)
60195 RETURN
```

A full implementation of this subroutine can be found at the end of this article.

Parameters for Main Program

Sending:	
Z$	Menu title
Z	Number of options
Z$(x)	Option text
Returns:	
Z	Number of selected option
Other Variables Used	
Z	Number of options/selected option
Z1	Loop variable/option number
Z2	Option length
Z3	Nested loop variable
ZZ	Title length
ZZ%	Positioning of first menu option
Z$	Title/option centring pad
ZZ$	Cursor placement
Z$(x)	Option text/text plus Z$ padding

```
PROGRAM: MENU SUBROUTINE
3C  1 Z$="THE MAIN TITLE CAN BE
    40 CHARACTERS LONG"
6B  2 Z=10
C2  3 Z$(1)="FIRST MENU ENTRY"
E4  4 Z$(2)="THE NEXT MENU ENTRY
    "
B4  5 Z$(3)="THE THIRD MENU ENTR
    Y"
79  6 Z$(4)="MENU OPTION FOUR"
E9  7 Z$(5)="NUMERO FIVE"
7F  8 Z$(6)="SIXTH"
42  9 Z$(7)="OPTION 7 USES THE M
    AXIMUM 39 CHARACTERS"
3C  10 Z$(8)="THE[SSPC]EIGHTH[SS
    PC]MENU[SSPC]ENTRY"
11  11 Z$(9)="YET ANOTHER OPTION
    "
36  12 Z$(10)="AT LAST! NUMBER 1
    0"
B3  13 GOSUB60050
4C  14 PRINT"[CLR]":IFZ=7THENPRI
    NT"ONLY GREEDY PEOPLE SELECT
     OPTION"Z:GOTO16
91  15 PRINT"AH! OPTION NUMBER"Z
    "[LEFT]. A WISE CHOICE."
90  16 END
5B  60050 Z2=LEN(Z$):IFZ=0ORZ2>4
    0THENSTOP
1F  60055 PRINT"[CLR]":ZZ=(40-Z2
    )/2:PRINTSPC(ZZ)Z$;:IFZ2<40T
    HENPRINT
D1  60060 PRINTSPC(ZZ);:FORZ1=1T
    OLEN(Z$):PRINT"[SE]";:NEXT:I
    FZ2<40THENPRINT
C4  60065 PRINT"[HOME,DOWN22,CP4
    0]";
8D  60070 PRINT"[RVSON] HIGHLIGH
    T ANY OPTION WITH THE CRSR K
    EY ";
EE  60075 PRINT" THEN USE THE <R
    ETURN> KEY TO SELECT IT";:PO
    KE2023,160
F3  60080 ZZ%=7-Z/2:ZZ$="[RIGHT1
    0]"
E5  60085 PRINT"[HOME]":FORZ1=0T
    OZZ%:PRINT"[DOWN]";:NEXT
CE  60090 FORZ1=1TOZ:Z$="":Z2=LE
    N(Z$(Z1)):IFZ2>39THENSTOP
6A  60095 IFZ2/2=INT(Z2/2)THENZ2
    =Z2+1
B4  60100 IFZ2<39THENZ$=LEFT$(ZZ
    $,(41-Z2)/2)
1C  60105 FORZ3=Z2TO1STEP-2
BB  60110 PRINT"[UP]"Z$;LEFT$(ZZ
    $,Z3/2);
29  60115 PRINTMID$(Z$(Z1),Z3/2+
    .5,Z2-Z3+1):NEXT
51  60120 IFZ1<>ZTHENPRINT:PRINT
C5  60125 Z$(Z1)=Z$+Z$(Z1):NEXT
C8  60130 ZZ$="[HOME,DOWN21]"
7F  60135 Z1=1:PRINT"[RVSON]"LEF
    T$(ZZ$,ZZ%+2*Z1)Z$(1)
B8  60140 GETZ1$:IFZ1$="[UP]"THE
    NGOSUB60160
EB  60145 IFZ1$="[DOWN]"THENGOSU
    B60180
7E  60150 IFZ1$=CHR$(13)THENZ=Z1
    :RETURN
27  60155 GOTO60140
A5  60160 PRINTLEFT$(ZZ$,ZZ%+2*Z
    1)Z$(Z1)
7E  60165 Z1=Z1-1:IFZ1=0THENZ1=Z
3D  60170 PRINT"[RVSON]"LEFT$(ZZ
    $,ZZ%+2*Z1)Z$(Z1)
74  60175 RETURN
C9  60180 PRINTLEFT$(ZZ$,ZZ%+2*Z
    1)Z$(Z1)
3D  60185 Z1=Z1+1:IFZ1=Z+1THENZ1
    =1
49  60190 PRINT"[RVSON]"LEFT$(ZZ
    $,ZZ%+2*Z1)Z$(Z1)
80  60195 RETURN
```

Multi-Precision Arithmetic



This new maths program will enable you to deal with much larger numbers than is normally possible on the Commodore 64

The CBM64 has a limited ability to deal with large numbers accurately. Precise accuracy is only possible with integer arithmetic, and the '64 can only cope with numbers up to 32768 in integer mode. This is not a large number – for example it couldn't add up the number of people in most small towns, or cope with the number of pennies in my meagre salary.

Larger numbers can be dealt with in scientific notation, but still only up to 10 ∧ 32, and such numbers are not always completely accurate. Absolute accuracy with large numbers is needed, for example in pure mathematics, to determine if a number is a prime number. Very large prime numbers are the basis of important computer cipher systems (eg the Rivest-Shamir-Adelman system), which can be used to send confidential information on computer networks etc. It would therefore be useful to have the ability to work with large numbers without loss of accuracy.

This program allows the CBM 64 to perform multi-precision arithmetic with up to 8190 digits. This should allow calculation of any practical application, since it exceeds the total number of atoms in the known universe by quite a substantial margin. The ability to work with very large numbers can also be useful in pure mathematics and cryptography. The use of the program itself is very simple. The program acts as a calculator with three registers or memories, which can perform multi-precision addition, subtraction, multiplication and division. The routines can be used either in direct mode or within a BASIC program.

The registers are referred to as A for accumulator, and X and Y for the subsidiary memories. All calculations involve the accumulator, which will hold the result of the calculation. The X and Y registers are identical in their functions, and can be used in any calculation. All the calculations are in Integer arithmetic, and there's no provision for decimal points etc. The routines can of course be used to calculate numbers with decimal points, but programmers must keep track of the position of decimal points and so on for themselves.

The instructions for the calculator are all preceded by the # sign (hash), which allows the routine to recognise the new instructions. The existing keywords which use # , eg INPUT# , are not affected, and can be used as normal. The new instructions can be grouped into three types as follows:

Memory Transfers

These allow the contents of the three registers to be shifted around quickly and conveniently. Transfers involve copying the contents of one register into another. The original contents of the destination register are lost. The instructions are # TAX (Transfer A to X), # TAY (Transfer A to Y), # TXA (Transfer X to A) and # TYA (Transfer Y to A). An exchange between memories involves swapping the

contents of the two registers without losing any data. The exchange instructions are # EXA, #EYA AND #EXY.

Mathematical Instructions

These are the instructions that allow calculations to be performed between the A register and either the X or Y register. In all cases, the X and Y registers are unaffected by the operations, and the the A register is altered to hold the result of the calculation. # AXA adds the X register to the A register (Add X to A), and # AYA adds the Y register to A. # AAA adds the A register to A: ie, it doubles the A register without using X or Y.

SXA subtracts the X register from A (Subtract X from A), and must have the A register larger than or equal to X or a syntax error results. # SYA is identical but subtracts the Y register from A. # MXA multiples the X and A registers and # MYA multiplies Y and A registers. If the numbers in both registers are large, then the result will exceed the normal limit of 8190 digits. The A register has been made twice the size of the other registers to allow for this.

Multiplying two registers together will still give a valid result, even if both are set at the maximum number of digits, and the resulting number will be up to 16380 digits long. However, any further manipulation of the number is liable to produce errors. Subtraction will give correct results but addition, multiplication and even division may produce errors. Obviously transfers and exchanges with the other smaller registers are invalid, but are not flagged as errors.

MAT (Multiply A by Ten) multiplies the A register by ten without using X or Y registers. # DXA divides X into A. The remainder from the integer division is left in the A register, and the result of the division is in a temporary register, and ca i be swapped into A by # ETA (Exchange Temp and A). # DYA is similar for the Y register.

CXA compares the X and A registers and alters address 2 as follows:

A=X PEEK(2) returns 0
A>X PEEK(2) returns 1
A<X PEEK(2) returns 255 (-1 in 2's complement binary arithmetic)

The number should be read immediately, as several routines in the calculator use address 2 for temporary data storage. # CYA is again similar.

INX increments the X register by 1 without affecting Y or A. There is no # INY instruction: incrementing is only done on the X register. The incremental value is stored in RAM at $C867 (51303), and can be altered if required to any valid BCD number, but once changed it will remain at the new increment value till deliberately reset. Invalid BCD numbers will cause erroneous results.

To convert a normal two digit decimal into BCD format, the first digit is multiplied by 16 and added to the second digit: eg, 27 becomes 2*16+7 (39), simply POKE'ing 27 into $C867 is NOT valid as 27 does not correspond to any BCD number.

Input Output Instructions

IN inputs a number from the keyboard. Only the numeral keys and the delete key will affect the displayed number, and pressing the return key will terminate the input. Numbers of up to 8190 digits can be entered if required. (nb there is no flashing cursor in the routine).

SIA (String Into A) enters a string of numbers into the A register. # SIA is followed by a string in brackets eg SIA ("123456789"), or # SIA(STR$ (99*7+3 2)), the string must be an integer, but can be in exponential format eg 2.345E12, but must be normalised to only one figure before the decimal point. The string is restricted by the usual BASIC string limitations. String variables are not suitable for this routine, and may give spurious answers.

PRA (Print A register) simply prints the A register to any active device: eg, screen or printer. Because the numbers are stored in pairs – two decimal digits per byte – the print routine will always print an even number of digits. If the number of digits in a number is odd, then a leading 0 will be printed so 123 will print as 0123.

KPD and # KPT save (Keep) the contents of the A register to Disc or Tape respectively. Both require a name for the file to be saved: eg, # KPD"GOOGOL". # LDD and # LDT reload a previously saved number back into the A register. The routine needs the name of the file to be reloaded: eg, # LDD"GOOGOL".

The mathematical routines are accurate but somewhat slow, as they use decimal rather than binary arithmetic. The A register occupies the 8k of memory from 32768 to 40959 ($8000-$9FFF), and can be PEEK'd from Basic. This register is twice the size of the X and Y registers as mentioned earlier, and if the A register exceeds 8190, digits then transfers and exchanges will not give valid results.

The size of the number in the A register is identified as an "offset' by the values held in $2AB and $2AC (681, 682), and can be read using:
(PEEK(681)+PEEK(682)*256)*2+2

This will always give an even number of digits, so even if a single digit number is held, the expression will give the answer 2. Also 0 is considered a single digit number, and will return an answer of 2. The X and Y registers are stored under the BASIC ROM, and are not directly accessible to BASIC programs. the temporary register mentioned in the divide routine can be used for extra storage, but the contents of this register are affected by both multiplication and division routines.

The BCD (Binary Coded Digit) format is not often used in CBM64 programs, since compared to binary it is wasteful of memory. The BCD format stores two decimal digits in each byte of memory, so a single byte can represent numbers from 0 to 99 (binary can store from 0 to 255 in a single byte).

In BCD, each half of the byte represents one digit.

Bit no 7 6 5 4	3 2 1 0
HIGH DIGIT	**LOW DIGIT**

Each half byte is called a nibble (and whoever thought up that pun of a name should be shot), and the number in each nibble is represented by normal binary arithmetic:-

1 = 0001
2 = 0010
3 = 0011
4 = 0100
5 = 0101
6 = 0110
7 = 0111
8 = 1000
9 = 1001

The binary patterns 1010, 1011, 1100, 1101, 1110 and 1111 are not allowed in BCD, and will generate errors if allowed to creep into BCD calculations. Ten in binary is 00001010, but in BCD is 00010000, and the bit pattern 00010000 is 16 in binary. So if you're trying to directly interpret/alter numbers, you must take care to use the BCD system.

80 Column Software

How to get the most out of your 80 column chip

D. Kelsey

The C128 has been provided with an 80 column chip, but it has several facilities that aren't catered for by the operating system of the C128. There's a large amount of text available about the internal workings of this chip, and a brief description follows.

The 80 column chip has access to 16k of memory. This is expandable to 64k, and there are kits available that do this. It isn't possible to directly access this memory, as the 6502 processor can't actually 'see' it., so how *is* it accessed? Two memory locations are provided that communicate with the chip. One memory location contains a register number which is in the chip, and the other gives the contents.

Using this method, a register within the chip can be examined or changed. The registers provide different facilities, one of which is address selection of the 16k available, which then allows memory locations in the 16k to be read or modified. I won't go into how to access the registers.

The 80 column chip is capable of all sorts of interesting things. It can change the dimensions of the screen, give you 28 lines by 80 columns (if you want, that) a light pen can be used on the 80 column screen, user defined characters are possible, and smooth vertical and horizontal scroll is also available. Many other strange functions can be done, but the most useful one and the one that will be discussed here is the ability to display high-resolution graphics.

Hir-res is possible on 80 columns, but if you only have 16k, there are some limitations. It isn't easy to show if you only have 16k available, but on the whole, if you haven't had an upgrade then you only have 16k on the C128. I gather that some very early versions of the C128 did actually have 64k.

These limitations are to do with the fact that to have both hi-res and colour of dimension 640x200 (which is the standard hi-res output for the 80 column chip, although it should be possible to increase this) requires more than 16k. To get around this, the screen size was reduced to allow colour and hi-res. The new dimensions were 640x176. If you display graphics in monochrome mode, then a full 640x200 can be displayed, as there is no memory used for colour.

The programs presented here are concerned only with the facilities of hi-res, and a couple of useful text control options. The first program deals with manipulating the screen, and the second is a screen dump program that contains several special options to control how the screen is output.

Where the program resides

This package is stored at $F200 – $FDF4. It will run in either bank 0 or bank 1. When loading this package, you should specify the bank. Although it should be possible to use this program with other languages, you may have to relocate the software using a relocation program. The one limitation is that it cannot be stored in address range $D000 – $DFFF.

It's possible for Basic to overwrite the code – to stop this you have to set up certain pointers:

Loading in Bank 0

```
BANK 0:BLOAD "80COL.OBJ"
POKE 4627,244:NEW
```

Loading in Bank 1

```
BANK 1:BLOAD "80COL.OBJ"
POKE 54,244:POKE 58,244:CLR
```

The pokes at the end are used to stop Basic from overwriting the code stored. This last step won't be necessary unless you have a very large Basic program, or use a large amount of variables, however it's a good idea to do this just in case.

User Guide

There has been no wedge supplied to include extra Basic commands for these routines, but you may consider using the label-linker featured in the March '88 edition of *Your Commodore* to set up module subroutines and allow easy access to these routines from Basic.

The following routines are provided – a description followed by a BASIC and machine code call will be given. Make sure you're in the appropriate bank before trying to call the routine.

1. Poke80

Description: provides the facility to poke to the 80 column memory

BASIC:
SYS DEC ("F206"), CO, INT(AD)/256,AD-INT (AD/256)*256
where
AD = Address
range 0..16383 for 16k
range 0..65535 for 64k
CO = contents to be stored
M/C:

```
LDX    address hi
LDY    address low
LDA data
JSR $F206
```

2. Peek80

Description: provides the facility to peek the 80 column memory

BASIC:
SYS DEC ("F206"),, INT (AD)/256, AD-INT (AD/256) *256: RREG CO
AD = Address
range as above
CO = contents of address
M/C:

```
LDX    address hi
LDY    address low
JSR $F206
STA data
```

3. Mode select

Description: allows the mode of the 80 column chip to be changed from text to hi-res. The following options are available:
mode = 0 : display in text mode
mode = 1 : display 640x200 hi-res in monochrome
mode = 2 : display 640x176 hi-res in 16 colours
mode = 3 : display 640x200 hi-res in 16 colours (64k only)

The colour is displayed in the same way as hi-res on 40 columns. It's not possible to have a multicolour mode. If you have 64k and selected mode 3, selecting mode 0 will not clear the screen, ie. all the old text will be kept.

BASIC:
SYS DEC ("F20C"),MO
MO = mode number (0..3)
M/C:

```
LDA mode
JSR $F20C
```

Important: MODE 3 has not been tested. I haven't got 64k, so I wasn't able to test this mode. It is provided purely for a convenience for people with 64k.

4a Set Background Colour

Description: will set the background colour in the colour specified. In Hi-res colour mode the background colour is only displayed on the border. The actual screen colour stays black.

BASIC:
SYS DEC ("F20F"),CL
CL = Colour number (0..15)
M/C:

```
LDA colour
JSR $F20F
```

4b Set foreground Colour

Description: will set the foreground colour in the colour specified. Notice that this will only be noticed in 640x200 monochrome.

BASIC:
SYS DEC ("F212"),CL
CL = Colour number (0..15)
M/C:

```
LDA colour
JSR $F212
```

5. Set point

Description: sets a point on the hi-res screen

BASIC:
POKE 254,CL (colour hi-res only)
SYS DEC ("F215"), INT (X/256), X-INT (X/256) *256,Y
CL = colour
X = x co-ord range 0 – 639
Y = y co-ord
range 0 – 199 for monchrome and mode 3 with 64k
range 0 – 175 for mode 2
M/C:

```
LDY ycoord
LDX xcoordlow
LDA xcoordhi
JSR $F215
```

6. Clear point

Description: clears a point on the hi-res screen

BASIC:
POKE 254,CL (colour hi-res only)
SYS DEC ("F418"), INT (X/256), X-INT (X/256) *256, Y
CL = colour
X = x co-ord ranges as above
Y = y co-ord ranges as above
M/C:

```
LDY ycoord
LDX xcoordlow
LDA xcoordhi
JSR $F218
```

6. Draw Line

Description: draws a line from two specified points

BASIC:
POKE DEC ("F223")+1, INT (X1/256)
POKE DEC ("F223"), X1-INT (X1/256) *256
POKE DEC ("F225"), Y1
POKE DEC ("F226")+1, INT (X2/256)
POKE DEC ("F226"), X1-INT (X2/256) *256
POKE DEC ("F228"), Y2
SYS DEC ("F229", 1 – to clear a line
SYS DEC ("F229"), 0 – to set a line
M/C:

```
LDA X1coordhi
STA $F224
LDA X1coordlow
STA $F223
LDA Y1
STA $F225
LDA X2coordhi
STA $F227
LDA X2coordlow
STA $F226
LDA Y2
STA $F228
LDA     (1= set, 0=clear)
JSR $F229
```

if any specified x,y coordinates are invalid, ie. if they are outside the ranges specified, then no data will be displayed on the screen.

7. Display Text

Description: this will put text onto an 80 column hi-res screen.

BASIC:
T$="text to be displayed"
FOR LO=1 TO LEN (T$)

```
POKE DEC ("F234")+LO-1, MID$
(T$, LO, 1)
NEXT LO
POKE DEC ("F233"), LEN (T$)
POKE DEC ("F232"), MO
SYS DEC ("F284"), INT (X/256), X-
INT (X/256) *256, Y
```

Where
X = X position on screen
Y = Y position on screen
MO = mode
0 = Upper case
64 = Reversed
128 = Lower case
192 = lower + reversed

M/C:
Place Text starting at $F234

```
LDA   length
STA $F233
LDA xcoordhi
LDX xcoordlow
LDY ycoord
JSR $F284
```

8. Draw Box
Description: this will draw a box on the screen and optionally fill it in.

BASIC:

```
POKE DEC ("F287")+1, INT (X1/
256)
POKE DEC ("F287"), X1-INT (X1/
256) *256
POKE DEC ("F289"), Y1
POKE DEC ("F28A")+1, INT (X2/
256)*256
POKE DEC ("F28C"), Y2
SYS DEC ("F28D"), MO, FF
```

Where
X1, Y1 = top left corner
X2, Y2 = bottom right corner of box
MO = draw mode. 1 = set, 0 = clear
FF = fill flag. 1 = fill box.

M/C:

```
LDA X1coordhi
STA $F288
LDA X1coordlow
STA $F287
LDA Y1
STA $F289
LDA X2coordhi
STA $F28B
LDA X2coordlow
STA $F28A
LDA Y2
STA $F28C
LDA MO (same as above)
LDX FF (same as above)
JSR $F28D
```

9. Swop Basic Screens
Description: allows two basic screens to be maintained from within a program. Not to be used in hi-res mode.

BASIC:

```
SYS DEC ("F22F"), CF
```

where
CF = clear flag. 1 = clear screen

M/C:

```
LDA CF
JSR $F22F
```

Other routines

1. SWOP
This routine is similar to the BASIC SWOP routine, but doesn't update any of the Basic screen pointers. This may be useful for programs that don't utilise the screen controller in the operating system. The calling address is $F22C. Register A is used as the clear flag, if A=0 then the screen isn't cleared. A=1 will clear the screen.

2. READ/WRITE registers
These routines allow calling of the registers from any BANK you are in. They are required for this package, and may be of some use to other programmers.

M/C:

```
LDX register number
JSR $F200
STA register contents
LDX register number
LDA value to be stored
JSR $F203
```

3. Block clear
The 80 column chip provides a rapid block data store facility. This routine allows easy access to this.

```
LDA start address hi
STA $F210
LDA start address low
STA $F20F
LDA No. of Bytes hi
STA $F212
LDA No. of Bytes low
STA $F211
LDA fill character
JSR $F213
```

Example program

A commented demonstration program has been provided to give examples of how to use these routines. To load, type DLOAD "80DEMO" and run at your leisure. Make sure that the 80 column package is also on the same disk as this program will try to load it.

Ending comments

This package provides just the basics for hi-res control. The chip is capable of many other things as well as described above, and if you are interested, a good book is the C128 programmers reference guide for further information.

Screen Dump program

This program provides a screen dump facility for 80 columns. The first thing to note is that it isn't possible to fit a full screen on a hi-res picture onto a Commodore compatible printer – any hi-res print is actually printed sideways. A test dump is printed the correct way. Also note that all text dumps will be printed in upper case only.

The driver is stored at locations $1300 – $1A6F, and cannot really be located easily. To load the program, you type in the following:
BANK 0:BLOAD "SD80.OBJ"

The program MUST be loaded into RAM 0, so BANK 0 is usually a good choice. The screen dump has variable control information so that different parts of the screen can be dumped individually. Different types of output are also possible.

Information required

The following information must be sent to the screen dump program before you start:

1. Starting X column on the screen.
2. Starting Y column on the screen.
3. starting Printer column.
4. Ending X column on the screen.
5. Ending Y column on the screen.
6. Control flag.
7. screen mode.
8. address of hi-resolution information.
9. Address of colour information.

Most of this information can be automatically set up using the driver program provided. This driver will also set up the correct starting and ending X,Y information, so that a whole screen is displayed. It will also select the correct screen mode and correct screen and colour addresses. The only information that needs to be set-up is the printer start column and the control flag.

Printer Start Column

The is a value from 0 – 79 which specifies how many characters from the left hand margin should be indented for the print, that is, it allows the output to offset from the left. Usually this value is zero.

To set this in Basic, BANK 0:POKE DEC ("1307"), PS
Where PS = printer start column.

Control Flag

This allows selection of the many facilities that the screen dump can provide. It is a binary flag, and requires some knowledge of binary to set-up.

128	64	32	16	8	4	2	1
X	X	E	D	C	X	B	A

The bits A-E affect what the screen dump will do.

A.
0 prints one dot across for every screen pixel
1 refers to bit B

B.
0 prints two dots across for every screen pixel (if bit A is set)
1 prints three dots across for every screen pixel

C.
0 prints one dot down for every screen pixel
1 prints two dots down for every screen pixel

D.
0 Shade mode off
1 Shade mode on

E.
0 shade background as well as foreground
1 shade foreground only.

X.
This bit does nothing, so keep as 0.

The actual meanings will be described later.

Once you've decided which options you want, you can then work out the value by creating the bit pattern and then converting the number to decimal.

For example, I want to print 3 dots across and 2 dots down, that means I require A=1, B=1, C=1. this gives a bit pattern of

128	64	32	16	8	4	2	1
X	X	E	D	C	X	B	A
0	0	0	0	1	0	1	1

Therefore, the number required is 8 + 2 + 1 = 11.

To set the control Flag, BANK 0:POKE DEC ("130B"), CO where CO = control flag. In the above case: BANK 0:POKE DEC ("130B"), 11

Description of options

Dots Across: you can specify up to three dots here. For each screen pixel, three dots will either be printed/or skipped across the page. This has the effect of expanding the screen across the page.

Dots Down: similar to above, but expands the screen down the page.

Shading: most printers are not capable of printing colour, so a method of shading is provided to simulate colour. Depending on the colour found, a special shade is displayed, thus giving output more depth. Sometimes, it's useful not to include the background colour as a shading to be printed. The option to turn it on or off is available.

One thing to note is that if you try to shade a full screen, it may not fit on your printer. You'll then have to reduce the size of the screen outputed. The screen size control is described later.

The driver

Once this information has been set up you can now call the driver. A flag is provided to say whether you want the full default option. If you want a full screen then you need to set the flag. In Basic, this is done by the command BANK 0:POKE DEC ("1303"), 1 (actually, you can be in any bank which has access to RAM 0). To run the SD program, type SYS DEC ("1300").

Selecting the screen dimensions

If you only want to print a portion of the screen, it's possible to select part of a screen to print. You must first turn off the default flag for the driver by typing BANK 0:POKE DEC ("1303"), 0 (again, it can really be any BANK which has access to RAM 0).
To set up the dimensions then:
POKE DEC ("1304"), XS-INT (XS/256) *256: POKE DEC ("1304")+1, INT (XS/256)
POKE DEC ("1306"), YS
POKE DEC ("1308"), XS-INT (XE/256) *256: POKE DEC ("1308")+1, INT (XE/256)
POKE DEC (1300A"), YE
where XS, YS is the top left hand corner of the screen
XE, YE is the bottom right hand corner of the screen

You have to make sure you get the dimensions right for the correct screen mode. For example, if I have a screen in hi-res with dimensions 640x176, then I may set the screen print dimensions to:
XS = 50 : XE = 589
YS = 20 : YE = 175
a full screen has dimensions
XS = 0 : XE = 639
YS = 0 : YE = 199

Defining your own screen addresses

If you have a good knowledge of the internal workings of the 80 column chip, then you may want to set up your own screen and attribute addresses where the screen dump program gets the information. This is possible by not going through the driver at all. To do this, you have to set up the following addresses

$130E	screen low address
$130F	screen hi address
$1310	attribute low address
$1311	attribute hi address

Once this and all the above parameters are set up, you call the basic dump program by BANK 0:SYS DEC ("   ").

Screen Dump Key

The final facility is a screen dump key. If you want to make a copy of a screen, then a simple key press would be very useful. The screen dump key will go through the driver program, and the required parameters such as the control flag will need to be set.
To activate the screen dump key, type BANK 0:SYS DEC ("1312").
To dump a screen, press CTRL   .
To deactivate this facility, type BANK 0:SYS DEC ("1315").

You may like to set up a boot program that loads the screen dump program and sets the default flag on, printer start and control information and activates the screen dump key. The key is automatically ready for use.

One final Note – you must be in a BANK which allows access to the address $1300 in RAM 0. In the above examples, BANK 0 was used to do this, but this isn't the only choice, for example, BANK 12 would work just as well. Also once a bank is selected in, it stays in that bank until changed, so you only have to set the bank once.

Demo Program

The Screen Dump key is activated during the running of the demonstration program. At any time you can get a screen dump, if you require one.

Autoscroll

Perfect scrolling is possible on the 64, and this program proves it

by Derek Tripp

Some versions of Basic (though not, of course, the one you get with the C64!) offer the programmer the facility to scroll part of the screen, and leave the rest permanently on display. This can be very useful if you want to show a table of results, with headings for each column and a set of instructions ("Press-any-key-to-halt" type of thing) at the bottom.

You know damn well that if you try this with the C64, and the results occupy more than the 20-odd lines left on the screen, the heading will disappear off the top, and bits of the bottom line will stick out of one line and scroll up the screen with your data. So apart from being unable to remember what each column means, you're left with an untidy display, and the frustration of not remembering the instructions telling you how to stop the flood of data!

While we're about it, there's no elegant way to set up that bottom line and then return to the top of the table in the first place:-

```
10 PRINT"[CLR/HOME]  ITEM   NUMBER   PRICE   TOTAL'
20 PRINT         OFF          EACH       COST"
30 FOR I=3 TO 24:PRINT"[DOWN]";:NEXT
40 PRINT "     PRESS ANY KEY TO HALT";
50 PRINT"[HOME][3 DOWN]";
```

That's one solution, but it's a bit clumsy, isn't it? Again, some versions of basic give you a "PRINT-AT" command, which allows you to put a line of text anywhere on the screen at any time.

AUTOSCROLL contains two short machine code routines that give you these missing facilities. The scrolling routine works just like the normal screen scroll, except that it starts when the text reaches the line you specify as "lower", and leaves the lines above the one you specify as "upper" where they are. You also get the normal facility for slowing the scroll by holding the "CTRL" key down.

The second routine simulates the "PRINT-AT" command, moving the cursor to the specified position anywhere on the screen. To keep things simple, and to minimise on the length of the code to be typed in, the routines are accessed via an "SYS" call, rather than by adding new words to basic. AUTOSCROLL was developed initially for use with the data-formatting program "TABULATE" that first appeared in the April 1988 issue of *Your Commodore.*

Getting Autoscroll Into Your Own Programs

There are several ways in which you can get this routine into your library of goodies, and add it as required to new and existing programs. Which way you choose will depend on the number of utilities, other versions of Basic etc, you have, or can borrow!

For those who have no "add-ons" of any kind, a Basic loader listing is given. There are two ways of using this loader. The most obvious way is to tack it onto the end of your own program, and use it as a subroutine called up by "GOSUB 63039". In this case, the "END" in line 63056 should be replaced by "RETURN".

If you choose to use it this way, you must make sure that all DATA statements in your own program have been read before you call the loader up. If they haven't, it will read the earlier data instead of its own, and the resulting machine code will not be what was intended. In all probability, the first "SYS" call to one of its routines will send the computer into a lock-up state, and you'll have to switch it off to reset it before it will talk to you again!

As an alternative which avoids this problem you can renumber the loader program and put it as the first part of your own program. If you do it this way, leave out the "END" in line 63056, and change the variable LN in line 63039 and the "THEN" address in line 63051 to suit your new numbering system.

With either method, you'll have to type the whole thing in by hand each time you want to add it to an existing program, unless you have access to a "MERGE" or "APPEND" utility that does the job for you. For new programs, of course, you start by loading AUTOSCROLL and then write your own program before or after it, as the case may be.

You may "crunch" the loader program by omitting all the REM and spacing lines, and by the usual horrible trick of cramming as much onto one line as you can. Check-run the loader program at any stage as you enter it – it doesn't "self-destruct" as some loaders do! This allows you to be sure it's OK before you save it to disk or tape. However, don't try to check the machine code routines by the "SYS" call until you've saved the completed program!

If you have a utility cartridge or anything else that gives you access to a machine code monitor, you may enter the Basic Loader just as it is given, run it, and then use the monitor to save the machine code file that's produced to your disk or tape. Don't forget to call this by a different name to the one you've used to save the Basic loader program, though!

Those of you with an assembler will probably prefer to use the listing given in that format. In this case, you can relocate the routines as you wish to avoid clashing with any other programs you may want to use with them.

If you end up with a machine code file from using an assembler or monitor, you can load this from a suitable line in your Basic masterpiece

– making sure you have a copy of AUTOSCROLL on the same disk as (or if you use tape, immediately after) your Basic program.

I prefer to check to see if the machine code has been loaded into memory from either the Basic loader or machine code versions, with a PEEK or two to the area of memory used by the routines (see lines 310 to 360 of the DEMO program). This method has the advantage that while you're developing your own program and test-running it, you only have to load the routines once. If you use the more common method of putting a line such as:-

```
10 IF A=0 THEN A=1: LOAD "A/S",8,1
```

at the beginning of your program, then you have to wait while the machine code loads each time you RUN it. This is slow enough if it's loading from disk, but is even more annoying if it means running the Basic loader each time.

How To Use The Routines

You can use these routines in the "immediate' mode from the keyboard as well as from within Basic programs. The format to set up the scrolling area between "upper" and "lower" lines (where the top line is 1, and the bottom one 25), is:-

```
SYS 52992, upper, lower
```

To position the cursor on the desired "line" at the position "column" (where the left-hand margin is column 1, and the right-hand margin column 40), use the format:-

```
SYS 53018, line, column
```

To reset the computer to the normal scrolling mode, use:-

```
SYS 53032
```

So the example given before becomes:-

```
10 PRINT"[CLR/HOME]    ITEM    NUMBER    PRICE    TOTAL"
20 PRINT "             OFF     EACH      COST"
30 SYS 53018, 25, 1 :REM MOVES CURSOR TO START OF BOTTOM LINE
40 PRINT"       PRESS ANY KENY TO HALT";
50 SYS 53018,3,1 :REM PUTS CURSOR AT START OF TABLE
```

To set up the scrolling window, we note that, as the header in this example occupies the top two lines, the scroll should start at line 3. We have a "footer" line on line 25, so the scroll area should end at line 24. A line such as:-

```
60 SYS 52992,3,24
```

does the trick.

The Demonstration Program

Just in case you don't happen to have a suitable host program around, or you don't fancy risking it until you've tried these routines out on somebody else's work (coward), I've included a short demonstration program for you to try. At least, it would be short without all those confounded REM statements!

This has a few optional lines (read the REM statements before you leave them out!) which allow you to use it with either the basic loader or a machine-code version. If you use the latter with tape, change the device number in the appropriate line.

Does Autoscroll Clash With Other Programs?

As presented here, the machine code routines occupy 251 bytes at the top of the free RAM area between addresses $CF00 to $CFFA. In addition, they use the four spare zero page bytes $00FB to $00FE. The command "SYS 52992, upper, lower" brings the scroll routine into play by changing the output vector at $0326, which is restored by the command "SYS 53032".

The Basic loader uses the following variables:-

A0, CS, D, LN, RC
and line numbers 63010 (63039 if you leave out the REMs) to 63089, or whatever you renumber them to yourself.

Footnotes

1. AUTOSCROLL modifies the output vector at $0326. If you use a utility cartridge, especially one that offers a Centronics printer interface, it may modify this vector for its own purposes. In this case, SCROLL will probably work OK from within a Basic program, but will be taken out of play when the program ends and returns the computer to the READY state. So if you try OUT SYS 52992 in the "Immediate" mode, and nothing happens, disable your cartridge and try again.

2. AUTOSCROLL moves the contents of the text RAM around and, as this lies just below the area where your Basic program sits, it's necessary to protect the program area from corruption. You'll find that if you try to set a line number greater than 25 you will halt, from either the "SCROLL" or "PRINT AT" routines. You'll get the same result if you try to make 'lower' equal to or greater than 'upper', or if you try to use zero or negative values (sorry – you can't scroll backwards, or get the text to disappear up its own.... header?.... with this program!)

3. You may set the scrolled area anywhere within the normal screen. However, if you set 'lower' to 25 and the line you print ends with a carriage return, or fills the line, then the normal C64 scroll routine may operate and shift the whole screen up one extra line. The same thing may happen if 'lower' is set to 24, and the line printed spills over to line 25.

4. You can leave the scroll routine in action while you list a program, and edit the text within the window normally over all but the last line of the window. This is sometimes seen by the computer as being an 80-character line, even though it may really be a 40-character line. In this case, it reads the next line as part of the line you are editing, and you will, most likely, get a "syntax error" message. I have not yet succeeded in curing this little bug yet – if anyone can find a solution with a few extra bytes, do let me know.

Basex

Suop up your 64 with this new Basic Enhancer

By Peter Finch

Basex – or Basic extension – is an 8K machine code program residing in memory from $8000 to $9FFF above Basic. It extends the crude Basic resident on the Commodore 64, and enables the user to utilise the powerful hardware capabilities of this machine, without the need for numerous complicated POKE statements to locations which must either be memorized (!), or looked up in a reference manual.

Furthermore, the default memory map is reorganised to utilise the (normally unused) shadow RAM, hidden behind the ROMs, for the memory-expensive high-resolution graphics screen, leaving more Basic bytes free. The complete character set is user-definable, and is also located in shadow RAM.

BASEX is used in the form of keywords, and operators which are tokenised in the same way as Basic. As with Basic, an abbreviated entry of the first few letters and a shifted letter is acceptable and will save time. The utilities cover four areas:

Sid Chip Control

SOUND – Define general sound volume and filters.

Syntax: SOUND 0 – disable SID
SOUND nl, n2 [,n3, n4, n5].

nl filter mode 0-15 (1 low pass, 2 band pass, 4 high pass, 8 voice 2 off – can be additive eg. 5 notch reject=low+high).

n2 volume 0-15.

n3 filter resonance 0-15.

n4 filter voice 0-15 (1 voice 0, 2 voice 1, 4 voice 2, 8 external).

n5 filter cut-off frequency 0 (=30 Hz) – 2047 (=20 KHz).

ENVELOPE – Define envelope for each voice.

Syntax: ENVELOPE nl, n2, n3, n4, n5, n6

nl voice number 0-2.

n2 attack 0-15.

n3 decay 0-15

n4 sustain 0-15.

n5 release 0-15.

n6 pulse width 0-4095 (proportion of pulse high eg. 2047=50%).

VOICE – Produce sound of certain pitch and timbre.

Syntax: VOICE nl, n2 [,n3, n4, n5]

nl voice number 0-2.

n2 frequency 0-65535 (= Hz * 16.77216).

n3 waveform 1-8 (1 triangular, 2 sawtooth, 4 pulse, 8 noise).

n4 special effects 0-2 (1 synchronise, 2 ring modulate).

n5 duration 0-255 (=seconds*50).

Note: Use full syntax for first sound, thereafter can use short form to change frequency eg. in glissando. End of sound can be detected by PEEK ($335+nl)=0.

Vic Chip Control

(Colour parameters – 0 black, 1 white, 2 red, 3 cyan, 4 purple, 5 green, 6 blue, 7 yellow, 8 orange, 9 brown, 10 light red, 11 grey1, 12 grey2, 13 light green, 14 light blue, 15 grey3).

MODE – Change screen mode.

MODE 0,nl Text, background nl.

MODE 1,nl,n2 Graphics, background nl, cursor n2.

MODE 2,nl,n2,n3 Multicolour text, background nl, cursor1 n2, cursor2 n2.

MODE 3,nl,n2,n3 Multicolour graphics, background nl, cursor1 n2, cursor2 n3.

MODE 4,nl,n2,n3,n4, Extended text, background1 nl, background2 n2, background3 n3, background4 n4.

CLS – Clear the text screen. (Will alter graphics colours).

CLG – Clear the graphics screen. (Will obliterate characters in text mode).

CSR – Change cursor color.

Syntax: CSR n (n=0-15 in text mode, 1-3 in mode 3)

EDGE – Change screen border.

Syntax: EDGE n (n=0-15).

SCROLL – Scroll text screen.

Syntax: SCROLL n (n=0 up, 1 down, 2 left, 3 right)

BAR – Draw a vertical bar in text mode.

Syntax: BAR nl, n2

nl Horizontal displacement 0-39.

n2 Vertical displacement 0-199.

PLOT – Plot a point on screen.

Syntax: PLOT nl, n2

nl Horizontal axis 0-79 text mode, 0-319 mode 1, 0-159 mode 3.

n2 Vertical axis 0-49 text mode, 0-199 graphics mode.

DRAW – Draw a straight line from last point plotted.

Syntax: DRAW nl,n2

Parameters as for PLOT.

CIRCLE – Draw a circle (ellipse in mode 3).

Syntax: CIRCLE nl,n2,n3

nl Radius.

n2,n3, X,Y position of centre. Parameters as for PLOT.

FILL – Fill graphics screen area within plotted boundary.

Syntax: FILL nl,n2

Fill starting from position nl,n2 = X,Y.

MOB – Define a movable object block (sprite).

Syntax: MOB nl (de-activate MOB nl)

MOB nl,n2,n3,n4,n5[,n6,n7].

nl MOB number 0-7.

n2 MOB data address in Bank 3 0-255 ($C000+n2*$40).

n3 Expansion 0-3 (1 Y expanded, 2 X expanded, 3 both).

n4 Priority 0 Data > MOB, 1 MOB > data.

n5 Colour.

n6 Colour2 (Multicolour MOB).

n7 Colour3.

MOVE – Move a MOB.

Syntax: MOVE nl,n2,n3

nl MOB number 0-7.

n2 Horizontal position (0-320 visible).

n3 Vertical position (29-229 visible).

1. Sound generation by the SID chip.
2. Graphics produced by the VIC chip.
3. A disk monitor.
4. Programming structures including function key definitions.

The Commodore operators are extended to include hexadecimal, binary, label variables with more than two significant letters, and numeric output with tabulated decimal places. In addition, there is a full two pass labelling assembler used from Basic, which even allows conditional assembly. Other machine code utilities include a disassembler, memory display in hex and ASCII, memory load and save.

Summary of Basex Contents

[] = optional parameters, n= numeric parameter, s$ = string DISK – Access disk monitor with directory ($) and usual commands (C, I, N, S, UJ, V). X to exit. Status = < CR > alone. Syntax: DISK n-n defines the device number (usually 8).

User Defined Graphics

The character set is defined in shadow RAM starting at $E000, and may be redefined as required. This area of memory appears to be write-only because of the shadow effect, thus reading it will give erroneous values. A redefinition is conveniently performed in hexadecimal using the 8 byte poke with "*:". For example the Commodore logo can be defined at $E000 and will appear instead of . Note however that this character will still be treated in exactly the same way as

```
$E000 00011100 $1C
$E001 00110110 $36
$E002 01100111 $67
$E003 01100000 $60
$E004 01100111 $67
$E005 00110110 $36
$E006 00011100 $1C
$E007 0000000 $00
*:E000 1C 36 67 60 67 36 1C 00
```

Programming Features

APPEND – Append a program to that already in memory.
Syntax: APPEND s$, n1
Load file s$ from device n1.

AUTO – Automatic line numbering. STOP to escape.
Syntax: AUTO [n1,n2]
n1 Interval (default 10).
n2 First line number (default 10).

DELETE – Delete line numbers within range.
Syntax: DELETE n1,n2
Delete from line n1 to line n2.

DUMP – Screen dump to printer.
Note: requires OPEN 4,n to printer – assumes Epson type for graphics dump.

KEY – Define function keys. (F1 set to TAB).
Syntax: KEY n1 (clear function key n1)
KEY n1, s$[-].
n1 Function key number 2-8.
s$ String definition (max length 8).
- Automatic carriage return.

OLD – Undoes the effect of NEW.

PIC – Define decimal places for numeric output with !
Syntax: PIC n1
n1 Number of decimal places 0-9.

RENUMBER – Line renumber (including GOTO/GOSUB etc).
Syntax: RENUMBER [n1,n2]
n1 Interval (default 10).
n2 First line number (default 10).
REPEAT: UNTIL/WHILE (condition) – Structured programming.
Example: J=0: REPEAT: PRINT J: J=J+1: UNTIL J=10.
J=0: REPEAT: PRINT J: J=J+1: WHILE J 10.

Operators

PRINT n1,n2,s$ – Prints string s$ at row n1, column n2.
£n1 – Outputs n1 as a hexadecimal string.
!n1 – Outputs n1 as string with tabulated decimal.
s – Outputs hex string s$ as numeric variable.
%s$ – Outputs binary string s$ as numeric variable.
.NAME – Label from assembler as numeric variable.

Machine Code Features

***ASS** – Commence two pass labelling assembler.
Syntax: *ASS n1.
Commence assembly at address n1, terminated by *END. Assembler code can include complex operands, including labels which must be signified by .name; such code must be tokenised. However, tokenisation of opcodes (eg AND, ORA) and labels must be suppressed by REM (which is ignored). Note the use of EQU – a multipurpose DB/DS to define bytes or string in memory. Characters to the right of ; are ignored. Labels are assigned the value 65535 ($FFFF) on first pass – thus .LABEL+1 will fail unless the label has been assigned before the reference.

Example:

```
10 MA=$7F : LO=$C000 : REM = MASK, LOCATION
20 *ASS $C800
30 .START LDA .MESSAGE/256 : LDY $C8 ;Ignore this
40 REM AND MASK : STA LOCATION
50 REM RTS
60 .MESSAGE EQU $93, "This is a message",13,$D
70 *END
80 SYS .START :REM Call this (nonsense) program
```

***DIS** – Disassemble machine code.
Syntax: *DIS n1[,n2]
Disassemble memory contents from n1 to n2, a page at a time.

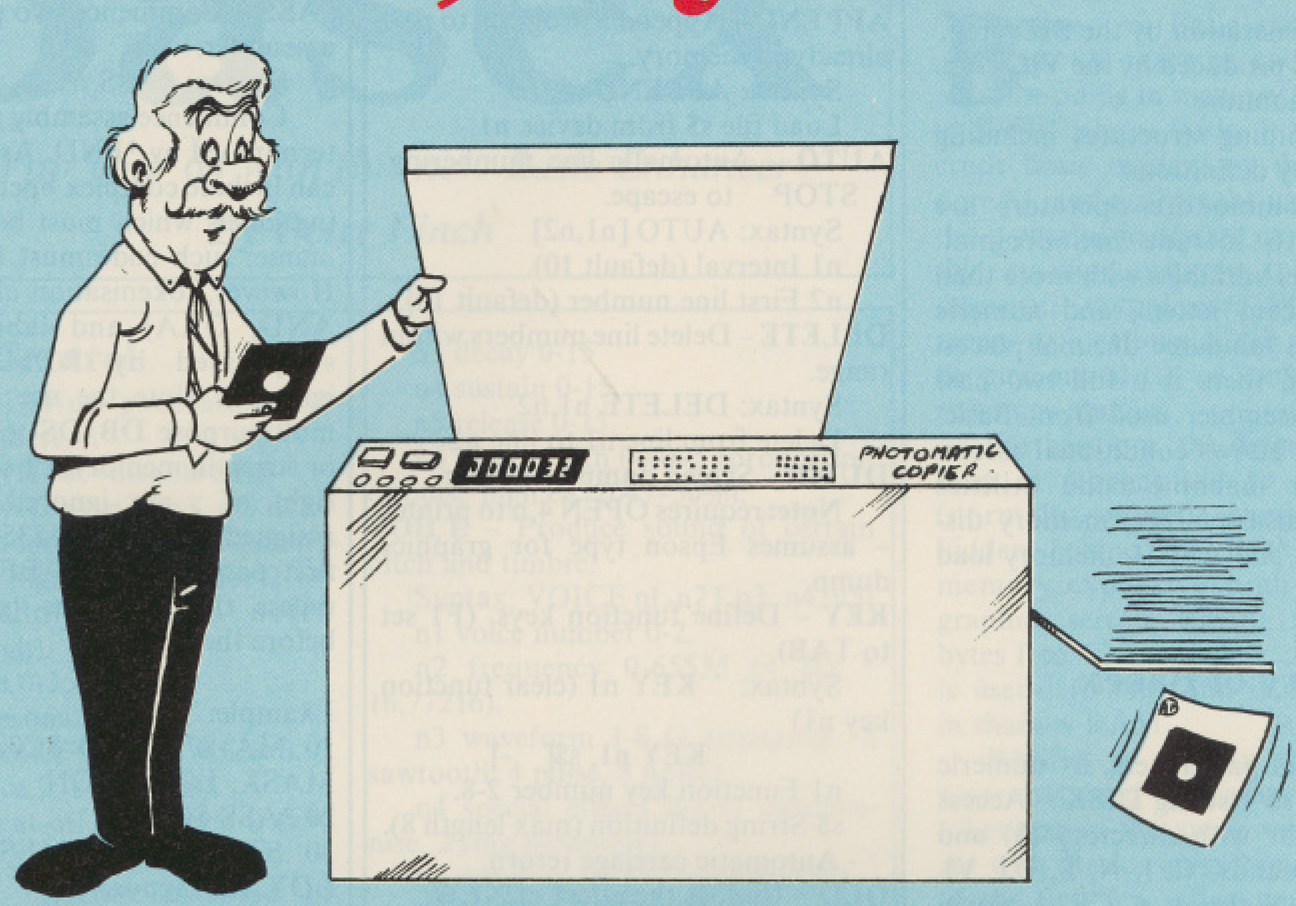
***LOAD** – Load code without disturbing BASIC pointers.
Syntax: *LOAD s$,n1
Load file s$ from device n1 to header address.

***MEM** – Display memory in hexadecimal and ASCII.
Syntax: *MEM n1[,n2]
Display memory contents from address n1 to n2

***SAVE** – Save code from anywhere in memory.
Syntax: *SAVE s$,n1,n2,n3
Save file s$ on device n1, from address n1 to n2

*: – Eight byte hexadecimal POKE.
Syntax: *:C000 AA 55 AA 55 AA 55 AA 55
Poke the eight hexadecimal bytes to memory (here to $C000)

Zeus, by Jove!



Mark Everingham's new program, ZEUS, will allow you to copy disk files of any length

A notable omission from the otherwise excellent CBM Disk Operating System provided on the C16 and Plus/4 computers is the facility to copy disk files from one disk to another. The ZEUS Megacopier has been designed to remedy this.

There are in fact two ways of copying files from disk to disk, but both involve considerable problems. The first is to use the "SD.BACKUP" program provided on your disk-drive system disk, but this program will only copy whole disks, which is a tremendous waste of time. It also means that any files previously on the disk will be lost. The second method is to use one of the many simple file-copier programs available. The problem with these is that they can only copy files of up to around 200 blocks in length. If you're using such a program on a C16, the state of affairs is even worse – you'll be limited to copying files of up to 48 blocks or so.

Not being able to copy files longer than the capacity of your computer may not seem a great disadvantage, but if you use your computer for any serious programming or data storage, you'll realize that it's a bit ridiculous only being able to copy files 48 blocks long when a single floppy-disk can contain files up to 664 blocks in length! This is where ZEUS comes in.

ZEUS is a file-copier program of the second type mentioned above, but it can copy files of any length. ZEUS will copy files of any length from a one block midget to a 664 block giant. In fact, ZEUS can copy files of infinite length, so it can also be used on a 1581 drive to copy the huge 2000 block files that are possible. ZEUS can also be of use to owners of C64's and C16's or Plus/4's – if you have a C64 file of say 250 blocks that you can't copy using your C64, just copy the file using ZEUS on your C16!

How Does Zeus Work?

Conventional file-copiers work by loading a file into memory, waiting for you to change the disk in your Disk-drive, and then saving the file back onto the new disk again. This means that you cannot copy files longer than the capacity of your computer – about 12k on a C16 or 60k on a Plus/4. ZEUS works in a slightly different way. The process for copying a file is shown below:-

LOOP
1. Load 1st "Chunk" of data
2. Change Disk in Disk-Drive
3. Save 1st "Chunk" of data
4. Have we loaded & saved the whole file? Yes – Jump to FINISH
5. Read 1st "Chunk" of data
6. Jump to LOOP for 2nd, 3rd, 4th "Chunks" etc...

FINISH
7. End

The operation of ZEUS relies entirely on the Append function of CBM DOS (OPEN n,8,n,"FILE-NAME,t,A"). This function allows your computer to add data to the end of a disk-file, and it's this function which is used in stage three of the copying process. By the use of a number of manual disk changes, files of infinite length can theoretically be copied!

Starting To Use Zeus

When you first run ZEUS, you'll see the screen divided into three "Windows" by two horizontal lines. In the first window, which is called the Title Window, you'll see a Title message and below this, the text "SOFTWARE RUNNING ON CBM???", where ??? is the type of your computer – C16 or +4. ZEUS automatically configures itself to whichever computer you're using in order to make full use of the facilities offered by each.

Below the Title Window is the Status Window. At the top of the window should be the text "TYPE/FILENAME:" followed by a flashing line-cursor. Underneath this should be two messages: "BLOCKS COPIED:-" and "KILOBYTES COPIED: -". The "TYPE/FILENAME" message is explained later, as are the other two.

The third window, at the base of the screen, is the Dialogue Window. In this window is displayed all the requests or information from your computer. At present it should be displaying the message 'ENTER COPY FILE-NAME AND PRESS (RETURN)".

Copying a File

The first thing to do before running ZEUS to copy a file, is to remember the file-name and type of the file. These can be found by looking at the Disk Directory. The file-name should be apparent, the type is one of PRG, SEQ or USR and is displayed on the left of the directory. ZEUS cannot copy relative files, as these have complex file structures.

When you know the file-name and type of the file to be copied, load and run ZEUS. You should then push either "P", "S" or "U", to tell ZEUS what type of file you wish to copy. This character should appear in the status window on the screen, followed by an oblique stroke. You should then type in the file-name of the file to be copied, and press [RETURN]. The File-name you specify should not include "?" or "*" characters, and ZEUS will reject these itself. You can use the (DEL) key to delete characters, or if you make a mistake or want to exit ZEUS, you can press the (ESC) key to return to BASIC.

Once you've entered the Type and File-name, the cursor will disappear and the message in the dialogue window change to "INSERT SOURCE DISK AND PRESS (RETURN)". At this point, insert the disk on which the file to be copied is found into your disk-drive, and hit (RETURN). The disk should start to whirr.

When you press (RETURN), the dialogue window should display the message "- SEARCHING FOR SOURCE FILE –". After a few seconds, this should change to "LOADING SOURCE FILE DATA –". At this point, ZEUS starts loading data into RAM, and the Status Window should show the "BLOCKS COPIED" and "KILOBYTES COPIED" counters increasing as the data is loaded. "BLOCKS COPIED" is the number of 254-byte disk blocks that ZEUS has copied, and "KILOBYTES COPIED" is the number of 1024-byte Kilobytes that ZEUS has copied. In one pass, ZEUS loads 41 blocks on a C16 or 230 on a Plus/4.

When ZEUS has finished loading a chunk of data, the dialogue message changes to "INSERT DESTINATION DISK & PRESS (RETURN)". At this point you should remove the original disk from your disk-drive, replace it with the disk onto which you wish your file to be copied, and press (RETURN). The message "– OPENING DESTINATION FILE –" will be displayed, and ZEUS tries to open a new file to copy data to. If it is successful, the message "– WRITING DATA TO NEW FILE –" is displayed and ZEUS starts writing data to the new file.

As ZEUS finishes writing data to its new file, one of two things will happen. If it's copied the whole of your file, the message "– COPYING PROCESS COMPLETE –" will be displayed in the dialogue window, and ZEUS will return to BASIC with the file copied. If, however, there is still more of your file to be copied, then the message "INSERT SOURCE DISK AND PRESS (RETURN)" will be displayed in the dialogue window. Do as ZEUS instructs, and after "– SEARCHING FOR SOURCE FILE –", ZEUS will say "– READING SOURCE FILE DATA –". At this point, ZEUS skips past the first chunk of data in order to load the second. When it has done this, the message "– LOADING SOURCE FILE DATA –" is shown, and the process described above is repeated until the whole file has been copied.

When ZEUS returns to BASIC, you'll find on your destination disk a perfect and identical copy of the original file you selected. If anything goes wrong during the process of copying a file, ZEUS will display a suitable error message. It then displays the message "PRESS (RETURN) TO ACKNOWLEDGE" and when you do so, ZEUS returns to Basic. ZEUS will cope with any standard DOS error message and displays the Error Number, Message and Track & Sector at which the error occured. Full explanations of these messages may be found on page 176 of your computer's manual. Alternatively, consult page 53 of your disk-drive manual.

The process of copying very long files can take quite a long time between disk changes, so in addition to the message ZEUS displays, it makes two sounds in order to inform you what it is doing, or to attract your attention to change disks or acknowledge a disk error. In essence, a low frequency bleep indicates that ZEUS has finished part of the copying process. A high frequency bleep indicates that ZEUS requires some human input or a disk change. When a disk error occurs, ZEUS bleeps alternately high and low to attract your attention. The use of sounds means that you are not continuously tied to the computer doing nothing!

Getting Zeus "Up & Running"

As you can see, the process of copying a file is quite straightforward when using ZEUS, and getting the program working is equally easy. The process is as follows:-

1. Type POKE 5888,0:POKE 44,23:NEW
2. Enter the ZEUS LOADER program
3. Type RUN and follow the instructions given by the program

When you've done the above, there will be saved on your disk two files: "ZEUS LOADER" and "ZEUS". To copy a file, just reset your machine and type:-

1. DLOAD "ZEUS"
2. RUN

ZEUS will now be in operation, and you can rerun the program as many times as you wish to copy more than one file. If you then want to run another program or write your own, you should press the (RESET) button on your computer before starting to do so.

Contributions

So you own a Commodore? So you've written some programs? So why haven't you sent them to us?

Your Commodore is always on the look out for new programs, hints and tips, articles and even regular series. In fact if you have something that you think could be of use to other Commodore owners we want to hear about it.

So if you have got something which you think we may be interested in. How do you go about submitting it to us?

Below you will find a list of guidelines that will help us to deal with any item that you send in to us. We don't expect everybody to be the next William Shakespeare but if you do follow these simple rules then it will make our job a lot easier.

1) If possible all material sent to the magazine should be typed or printed out on a computer printer.

2) All text should be double spaced i.e. there should be a blank line between each line of text. You should also leave a margin of about 10 characters around the text.

3) On the very first page you should put the following:
   Name of the article
   Machine that it is for
   Any extras required – disk, printer etc.
   Your name
   Your address
   Your telephone number

4) The top of every page should have the following information on it:
   Abbreviation of the article title
   Your name
   The page number

For example, suppose you had submitted an article on C64 interrupts. You should put something like the following at the head of the page:

Interrupts/J.Smith/1

5) Please make sure that you do not make any additional marks on your text especially underlining.

6) Try and write in clear concise English, it does not have to be a work of literature but it must be comprehensible.

7) On the bottom of each page you should put the word MORE if there are more pages to the article or ENDS if it is the last page.

8) If possible, enclose a listing of all programs.

9) Under no circumstances use a staple to hold the pages together. Use a paperclip instead.

10) Programs should be included on either disk or tape. Make sure that you SAVE two copies of every program so that we have a better chance of loading them if problems occur.

11) Programs under 10 lines can be included in the text. If your program is longer than this you must enclose a disk or cassette.

12) If your article needs any artwork then supply clear examples of what is needed. We don't expect you to be an artist but we do need to see what is required.

13) Photographs, if necessary, must be either black and white prints or colour slides. We can take shots ourselves so don't worry about this too much.

14) Submissions of any length are welcome. If you have a five line routine that you think may be of use to someone else we welcome it just as much as a full blown six part series.

15) Payment varies quite a lot and depends on quite a number of factors, such as complexity of program, presentation of program, number of magazine pages it takes up etc. Payment is generally between £10.00 and £800.00.

16) All payments are made in the month that the magazine containing your article has appeared in print.

17) If we do find your submission suitable for inclusion in the magazine we will write to you giving the terms of publication, the rate of payment and an agreement form. Prompt return of this form will allow us to use your program as soon as possible.

18) If you want the program returning to you, should we find it unsuitable for publication, then you should enclose a stamped self addressed envelope.

19) The last and most important point to make is 'get writing', we are waiting for your articles.

Software for Sale

If you think that one of our programs looks very interesting, but you can't afford the time to type it in, then our software service will help you out

It's three o'clock in the morning. You sit at the computer keyboard having just finished a marathon typing session entering one of the superb programs from *Your Commodore*. Your fingers reach for the keyboard and press the letters R, U and N. You press RETURN, sit back and nothing happens.

Everyone has probably faced this problem. When it does happen it's a matter of spending hours searching through the program for any typing mistakes. No matter how long you look or how many people help you, you can usually guarantee that at least one little but slips through unnoticed.

The *Your Commodore* Software Service makes available all of the programs from each issue on both cassette and disk at a price of £6.00 for disk and £4.00 for cassette. None of the documentation for the programs is supplied with the software since it is all available in the relevant magazine. Should you not have the magazine then back issues are available from the following address:

INFONET LTD, 5 River Park Estate, Berkahmsted, Herts, HP4 1HL.
Tel: (04427) 76661

Please contact this address for prices and availability.

The Disk

Programs on the disk will also be supplied as totally working versions, i.e. when possible we will not use Basic Loaders thus making use of the programs much easier. Unfortunately at the moment we cannot duplicate C16 and Plus/4 cassettes. However programs for these machines will be available on the disk.

What programs are available?

At the top of each article you will find a strap containing the article type, C64 Program etc. So that you can see which programs are available on which format, you will also find a couple of symbols after this strap. The symbols have the following meaning:

This symbol means that the program is available on cassette.

These programs are available on disk.

Please Note

Since the programs supplied on cassette are total working versions of the program, we do not put disk-only programs on tape. There is no sense in placing a program that expects to be reading from disk on to tape.

NOVEMBER 1988

SECRET WRITING — Learn how to conceal messages and how to protect your Basic programs (C64).
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WILLIAM TELL – Our popular arcade game for the C64.
+4 AUTORUN – Improve tape loading on your Plus/4 cassette. Only available on disk.
MINIBASE – A database for C128 owners.

ORDER CODE
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TAPE MENU – Add a menu system to your program cassettes (C64).
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MARCH 1989

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LETTER WRITER – An 80 column text editor for writing those personal letters (C64).

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WILLIAM TELL – Our very popular arcade adventure for the C64.

ORDER CODE
DISK YDMAR89 £6.00
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Cassettes or disks are available from March 1986. Please ring the editorial office (01-437 0626) for details of these.

ORDER FORM – PLEASE COMPLETE IN BLOCK CAPITALS

NAME	QTY	TAPE/DISK	ORDER CODE	PRICE
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Listings

Get it right first time with our deluxe program system for the C64.

You may have noticed that our listings are free of those horrible little black blobs which send you searching around the keyboard for a suitable graphic symbol. You may also have noticed the funny numbers by the side of each line of the listing. Fret no more, it's all part of our easy entry aid.

Instead of those nasty graphics and rows of countless spaces in PRINT statements and strings we use a special coding system. The code, or mnemonic, is always contained in square brackets and you'll soon learn to decipher their meanings.

For example, [SA] would mean type in a Shifted A, or an ace of spades in layman's terms, and [SA10] would mean a row of ten of these symbols.

[S+2] means hold down the shift key and press the plus key twice. It doesn't take a great leap of logic to realise that [C+2] means exactly the same thing except that the Commodore key (bottom left of the keyboard) is held down instead of the shift key.

If more than two spaces appear in a statement then this will be printed as [SPC4] or, exceptionally, [SSPC4]. Translated into English this means press the spacebar four times or in the latter case hold the shift key down while you do it.

A string of special characters could appear as:

[CTRL N, DOWN2,LEFT5,BLUE, F3,C3]

This would be achieved by holding down the CTRL key as you press N, press the cursor key down twice, the cursor left key five times, press the key marked BLUE while holding down the CTRL key, press the F3 key and, finally hold the Commodore key down while pressing the number two key (C2 would of course make the computer print in brown).

Always remember that you should only have a row of graphics characters on your screen with no square brackets and no commas, unless something like this appears:

[SS],[C*]

In this case the two characters should have a comma between them.

On rare occasions [REV T] will appear in a listing. This is a delete symbol and is created by entering the line up to this mnemonic. Then type a closing quotation mark (SHIFT & 2) and delete it. This gets the computer out of quotes mode. Hold down CTRL and press the number nine key (RVSON), type the relevant number of reversed T's and then hold down CTRL and press zero (RVSOFF). Next type another quotation mark and delete it again. Now finish the line and press RETURN.

A list of these special cases is given in the table but remember that only one of these mnemonics will appear outside of a PRINT string: the symbol for pi. This may appear when its value is needed in a calculation so this may look something like:

:CC=2*[PI]*R:

Ignore the square brackets and just type in a shifted upward pointing arrow (ie. the pi symbol).

```
PROGRAM: SYNTAX CHECKER

5 REM SYTAX CHECKER - ERIC DOYLE

10 BL=10    :LN=70    :SA=49152
20 FOR L=0 TO BL:CX=0:FOR D=0 TO
 15
30 READ A:IF A>255THENPRINT"NUMB
ER TO LARGE";LN+(L*10):STOP
40 CX=CX+A:POKE SA+L*16+D,A:NEXT
 D
50 READ A:IF A><CX THENPRINT"ERR
OR IN LINE";LN+(L*10):STOP
60 NEXT L:SYS 49152:NEW
70 DATA 173,5,3,201,165,208,31,1
20,169,9,141,32,208,141,33,208,1
847
80 DATA 169,7,141,134,2,169,13,3
2,210,255,169,64,141,4,3,169,168
2
90 DATA 192,141,5,3,88,96,120,16
9,124,141,4,3,169,165,141,5,1566

100 DATA 3,169,14,141,134,2,141,
32,208,169,6,141,33,208,88,96,15
85
110 DATA 32,124,165,72,138,72,15
2,72,162,0,165,20,133,254,165,21
,1747
120 DATA 24,101,254,133,254,189,
0,2,240,18,69,254,133,254,232,18
9,2346
130 DATA 0,2,240,8,24,101,254,13
3,254,232,208,233,169,1,141,134,
2134
140 DATA 2,165,254,74,74,74,74,3
2,156,192,32,210,255,165,254,41,
2054
150 DATA 15,32,156,192,32,210,25
5,169,13,32,210,255,169,13,32,21
0,1995
160 DATA 255,169,7,141,134,2,104
,168,104,170,104,96,24,105,48,20
1,1832
170 DATA 58,16,1,96,24,105,7,96,
0,0,0,0,0,0,0,0,403
```

by Eric Doyle

Checksum Program

The hexadecimal numbers appearing in a column to the left of the listing should not be typed in with the program. These are merely checksum values and are there to help you get each line right. Don't worry if you don't understand the hexadecimal system, as long as you can compare two characters on the screen with the corresponding two characters in the magazine you can use our line checking program.

Type in the Checksum Program, make sure that you've not made any mistakes and save it to tape or disk immediately because it will be used with most of the present and future listings appearing in Your Commodore.

At the start of each programming session, load Checksum and run it. The screen will turn brown with yellow characters and each time you type in a line and press the RETURN key a number will appear on the screen in white. This should be the same as the corresponding value in the magazine.

If the two values don't relate to one another, you have not copied the line exactly as printed so go back and check each character carefully. When you find the error simply correct it and press RETURN again.

If you want to turn off the checker simply type SYS49152 and the screen will return to the familiar blue colours. You can then do whatever it was you wanted to do and if this doesn't use the area where Checksum lies you can go back to it with the same SYS command.

No system is foolproof but the chances of two errors cancelling one Many of the listings are presented in lower case. To turn your computer to lower case mode press the Commodore key and the SHIFT key at the same time.

YC

Mnemonic	Symbol	Keypress
[RIGHT]		CRSR left/right
[LEFT]		SHIFT & CRSR left/right
[DOWN]		CRSR up/down
[UP]		SHIFT & CRSR up/down
[F1]		f1 key
[F2]		SHIFT & f1 key
[F3]		f3 key
[F4]		SHIFT & f3 key
[F5]		f5 key
[F6]		SHIFT & f5 key
[F7]		f7 key
[F8]		SHIFT & f7 key
[HOME]		CLR/HOME
[CLR]		SHIFT & CLR/HOME
[RVSON]		CTRL & 9
[RVSOFF]		CTRL & 0

Mnemonic	Symbol	Keypress
[BLACK]		CTRL & 1
[WHITE]		CTRL & 2
[RED]		CTRL & 3
[CYAN]		CTRL & 4
[PURPLE]		CTRL & 5
[GREEN]		CTRL & 6
[BLUE]		CTRL & 7
[YELLOW]		CTRL & 8
[POUND]	£	
[LARROW]	←	
[UPARROW]	↑	
[PI]		SHIFT & ↑
[INST]		SHIFT & INST/DEL
[REV T]		see text
[Cletter]		CBM + letter
[Sletter]		SHIFT + letter

Listings

Basex

PROGRAM: BASEX

```
11 10 PRINT"[CLR,DOWN10,RIGHT6]LOADING BASEX - PLEASE WAIT....."
99 20 C=C+1:IFC=1THENLOAD"BASEX.HEX",8,1
E5 25 REM * CHANGE ,8 TO ,1 FOR TAPE *
C2 30 SYS64738
```

PROGRAM: BASEX.BAS

```
22 10 BL=436:LN=50:SA=32768
5B 20 FOR L=0 TO BL:CX=0:FOR D=0 TO 15:READ A:CX=CX+A:POKE SA+L*16+D,A:NEXT D
77 30 PRINT".";:READ A:IF A><CX THENPRINT"ERROR IN LINE";LN+(L*10):STOP
86 40 NEXT L
7E 50 DATA 66,139,215,139,195,194,205,56,48,65,80,80,69,78,196,65,1890
D4 60 DATA 85,84,207,66,65,210,67,73,82,67,76,197,67,76,199,67,1688
CE 70 DATA 76,211,67,83,210,68,69,76,69,84,197,68,73,83,203,68,1705
3A 80 DATA 82,65,215,69,68,71,197,69,78,86,69,76,79,80,197,70,1571
03 90 DATA 73,76,204,75,69,217,77,79,194,77,79,68,197,77;79,86,1727
3B 100 DATA 197,79,76,196,80,73,195,68,85,77,208,80,76,79,212,82,1863
86 110 DATA 69,78,85,77,66,69,210,82,69,80,69,65,212,83,67,82,1463
63 120 DATA 79,76,204,83,79,85,78,196,87,72,73,76,197,85,78,84,1632
DD 130 DATA 73,204,86,79,73,67,197,65,83,211,68,73,211,77,69,205,1841
E7 140 DATA 0,76,144,205,144,154,148,35,154,70,147,67,229,33,142,103,1851
F5 150 DATA 144,254,139,71,150,26,142,154,141,100,151,184,145,97,153,99,2150
02 160 DATA 147,253,153,40,142,21,146,119,146,225,148,171,142,67,142,42,2104
47 170 DATA 148,79,141,93,142,90,142,191,141,143,131,159,136,68,133,116,2053
57 180 DATA 137,65,137,24,137,232,233,234,147,148,58,36,37,46,92,64.1827
E1 190 DATA 33,133,133,134,134,134,134,215,220,42,168,5,210,0,0,0,1695
1B 200 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
CB 210 DATA 230,122,208,2,230,123,32,121,0,240,9,201,59,208,5,32,1822
C4 220 DATA 115,0,208,251,96,189,128,132,205,15,2,240,6,202,16,245,2050
06 230 DATA 76,8,175,189,192,132,205,16,2,208,242,138,201,24,176,11,1995
86 240 DATA 160,3,74,144,2,9,128,136,208,248,96,105,39,201,72,144,1769
3B 250 DATA 239,105,7,201,88,144,233,105,39,201,136,144,227,105,55,201,2230
B3 260 DATA 200,144,221,105,11,201,216,144,215,41,3,176,211,32,121,0,2041
45 270 DATA 201,35,240,75,201,40,240,87,165,122,208,2,198,123,198,122,2257
E4 280 DATA 32,2,137,72,208,22,32,6,129,240,13,201,44,208,80,32,1458
75 290 DATA 0,129,208,251,104,162,20,96,104,162,4,96,32,6,129,208,1711
FB 300 DATA 4,104,162,12,96,201,44,208,54,32,115,0,201,88,208,7,1536
75 310 DATA 162,28,32,0,129,104,96,201,89,208,36,162,24,208,243,32,1754
DF 320 DATA 115,0,32,2,137,208,24,72,162,8,32,6,129,104,96,32,1159
58 330 DATA 115,0,32,2,137,72,32,121,0,201,41,240,27,201,44,208,1473
9A 340 DATA 48,32,115,0,201,88,208,247,32,115,0,201,41,208,240,162,1938
34 350 DATA 0,32,0,129,104,208,232,96,32,0,129,240,15,201,44,208,1670
FE 360 DATA 222,32,115,0,201,89,208,215,162,16,208,229,162,44,104,96,2103
47 370 DATA 0,76,8,175,162,3,32,115,0,240,246,72,202,208,247,142,1928
3C 380 DATA 16,2,162,3,104,56,233,63,160,5,74,110,16,2,110,15,1131
C4 390 DATA 2,136,208,246,202,208,237,32,0,129,208,18,162,67,32,21,1908
69 400 DATA 129,224,24,144,204,141,16,2,169,1,141,19,2,96,173,15,1500
A5 410 DATA 2,201,172,208,3,76,50,131,173,16,2,168,41,248,201,24,1716
67 420 DATA 208,8,152,201,26,240,3,76,239,130,32,93,129,140,17,2,1696
A5 430 DATA 141,18,2,134,75,160,2,72,104,240,1,200,140,19,2,173,1483
16 440 DATA 16,2,201,93,208,18,138,41,247,201,4,208,132,169,32,162,1872
B1 450 DATA 3,142,19,2,141,16,2,96,162,23,32,21,129,141,16,2,947
BC 460 DATA 165,75,168,224,2,176,12,41,247,201,4,208,222,152,13,16,1926
A2 470 DATA 2,208,225,208,13,232,41,32,9,12,234,234,234,13,16,2,1715
08 480 DATA 208,207,224,6,176,14,201,8,240,205,41,4,240,46,152,13,1985
53 490 DATA 16,2,208,192,224,8,176,12,201,8,240,187,41,20,201,4,1740
4C 500 DATA 208,169,240,234,224,16,144,231,224,21,208,12,201,8,240,167,2547
21 510 DATA 201,24,208,4,9,4,208,215,41,4,208,210,76,8,175,32,1627
E1 520 DATA 2,137,170,152,56,233,2,176,1,202,56,229,249,141,17,2,1825
28 530 DATA 138,229,250,168,165,255,208,16,44,17,2,48,6,192,0,240,1978
BE 540 DATA 6,208,28,192,255,208,24,234,169,2,141,19,2,162,47,32,1729
07 550 DATA 21,129,224,40,144,198,141,16,2,32,6,129,208,190,96,76,1652
97 560 DATA 72,178,173,16,2,201,52,208,179,32,121,0,201,34,240,40,1749
93 570 DATA 162,0,32,2,137,240,9,72,152,129,249,32,135,131,104,168,1754
02 580 DATA 152,129,249,32,135,131,32,6,129,208,6,169,0,141,19,2,1540
6E 590 DATA 96,32,253,174,208,214,240,132,32,115,0,162,0,161,122,201,2142
6E 600 DATA 34,240,7,129,249,32,129,131,208,241,32,0,129,208,226,240,2235
16 610 DATA 218,230,122,208,2,230,123,230,249,208,2,230,250,96,0,0,2398
14 620 DATA 32,2,137,133,250,132,249,133,252,132,251,164,49,165,50,133,2264
22 630 DATA 248,132,247,164,122,165,123,133,254,132,253,169,131,160,188,141,2762
80 640 DATA 9,3,140,8,3,169,1,133,255,96,0,0,32,115,0,201,1165
B6 650 DATA 143,240,249,201,172,240,50,201,46,208,3,32,55,132,165,122,2259
9E 660 DATA 208,2,198,123,198,122,32,4,130,172,19,2,165,255,208,12,1850
8D 670 DATA 136,185,16,2,145,249,136,16,248,172,19,2,152,24,101,249,1852
79 680 DATA 133,249,144,2,230,250.76,174,167,32,115,0,201,1
```

```
    28,240,3,2144
B2  690 DATA 76,8,175,198,255,48
    ,19,164,251,165,252,133,250,
    132,249,164,2539
2B  700 DATA 253,165,254,133,123
    ,132,122,76,174,167,160,208,
    169,138,141,9,2424
85  710 DATA 3,140,8,3,208,75,23
    0,122,208,2,230,123,177,122,
    145,247,2043
85  720 DATA 230,247,208,2,230,2
    48,96,164,255,208,6,32,244,1
    34,208,251,2763
05  730 DATA 96,136,32,38,132,20
    1,32,208,249,162,253,232,16,
    3,181,251,2222
03  740 DATA 44,169,0,32,46,132,
    138,208,242,165,247,133,49,1
    65,248,133,2151
CA  750 DATA 50,96,0,0,0,0,0,0,0
    ,0,0,0,0,0,0,0,146
90  760 DATA 0,32,115,0,208,138,
    240;159,169,32,44,169,13,76,
    210,255,1860
47  770 DATA 0,170,162,0,116,116
    ,116,114,196,202,38,72,68,68
    ,162,200,1800
30  780 DATA 26,26,38,38,114,114
    ,136,200,98,98,68,68,180,180
    ,244,242,1870
37  790 DATA 26,26,38,38,68,178,
    178,34,90,148,200,232,8,40,2
    04,164,1672
32  800 DATA 72,136,84,148,132,1
    10,74,138,104,50,0,0,216,38,
    84,104,1490
B0  810 DATA 0,26,91,0,165,105,3
    6,36,132,19,52,17,165,105,35
    ,160,1144
08  820 DATA 21,156,109,156,165,
    105,41,83,138,139,138,139,41
    ,168,83,83,1765
9D  830 DATA 21,156,109,156,174,
    168,41,124,28,27,29,29,25,25
    ,27,25,1164
45  840 DATA 35,161,35,161,174,3
    5,35,161,174,173,0,0,28,93,1
    57,157,1579
D2  850 DATA 162,1,181,250,72,18
    1,251,32,11,133,104,72,74,74
    ,74,74,1746
8D  860 DATA 32,35,133,170,104,4
    1,15,32,35,133,72,138,32,210
    ,255,104,1541
9B  870 DATA 76,210,255,24,105,2
    46,144,2,105,6,105,58,96,201
    ,48,144,1825
05  880 DATA 18,201,58,144,10,20
    1,65,144,10,201,71,176,6,105
    ,9,41,1460
CA  890 DATA 15,56,36,24,96,32,2
    ,137,132,251,133,252,132,253
    ,133,254,1938
71  900 DATA 32,121,0,240,7,32,7
    ,137,132,253,133,254,162,42,
    169,58,1779
39  910 DATA 32,26,133,32,0,133,
    32,120,132,160,0,177,251,32,
    11,133,1404
4F  920 DATA 32,120,132,200,192,
    8,208,243,160,0,177,251,41,1
    27,201,32,2124
D3  930 DATA 176,2,169,46,32,210
    ,255,200,192,8,208,238,32,12
    3,132,152,2175
D3  940 DATA 24,101,251,133,251,
    144,2,230,252,32,225,255,240
    ,17,56,165,2378
DF  950 DATA 251,229,253,133,255
    ,165,252,229,254,5,255,240,1
    75,144,173,96,3109
30  960 DATA 0,0,32,121,0,76,141
    ,174,169,0,133,13,32,115,0,1
    60,1166
37  970 DATA 5,217,219,128,240,9
    ,136,16,248,32,121,0,76,141,
    174,185,1947
B7  980 DATA 225,128,72,185,231,
    128,72,96,32,160,137,144,28,
    169,0,133,1940
9E  990 DATA 98,133,99,162,16,32
    ,244,134,233,49,240,4,73,255
    ,208,13,1993
8C  1000 DATA 38,99,38,98,202,16
    ,238,48,4,133,98,132,99,162,
    144,56,1605
E2  1010 DATA 32,73,188,76,121,0
    ,32,115,0,32,158,183,224,40,
    176,18,1468
B5  1020 DATA 138,72,32,241,183,
    104,168,224,25,176,7,24,32,2
    40,255,76,1997
03  1030 DATA 131,174,76,8,175,1
    69,46,56,76,243,188,160,1,17
    7,122,32,1834
75  1040 DATA 19,177,144,241,32,
    115,0,164,122,166,123,132,98
    ,134,99,162,1928
D8  1050 DATA 0,232,32,115,0,144
    ,250,32,19,177,176,245,134,9
    7,164,47,1864
0A  1060 DATA 166,48,132,100,134
    ,101,160,255,200,177,100,201
    ,32,240,6,209,2261
FC  1070 DATA 98,240,245,208,17,
    196,97,208,13,200,200,177,10
    0,72,136,177,2384
57  1080 DATA 100,168,104,76,249
    ,133,160,0,177,100,240,3,200
    ,208,249,152,2319
98  1090 DATA 56,101,100,133,100
    ,144,2,230,101,166,101,56,22
    9,49,138,229,1935
D7  1100 DATA 50,144,195,169,255
    ,168,208,219,0,170,74,74,74,
    74,32,35,1941
D4  1110 DATA 133,168,138,41,15,
    32,35,133,96,32,115,0,32,158
    ,173,32,1333
49  1120 DATA 247,183,169,0,141,
    4,1,165,21,32,153,134,140,0,
    1,141,1532
9F  1130 DATA 1,1,165,20,32,153,
    134,140,2,1,141,3,1,169,0,16
    0,1123
CF  1140 DATA 1,208,16,32,115,0,
    32,158,173,32,221,189,32,33,
    146,169,1557
FA  1150 DATA 174,160,2,133,97,1
    32,98,76,135.180,255,255,255
    ,255,255,255,2717
A3  1160 DATA 255,255,255,0,230,
    122,208,2,230,123,160,0,177,
    122,240,6,2385
47  1170 DATA 201,58,240,2,201,3
    2,96,0,168,74,144,11,74,176,
    23,201,1701
BE  1180 DATA 34,240,19,41,7,9,1
    28,74,170,189,140,135,176,4,
    74,74,1514
9B  1190 DATA 74,74,41,15,208,4,
    160,250,169,0,170,189,208,13
    5,133,255,2085
A5  1200 DATA 41,3,141,28,2,192,
    108,208,2,160,76,152,41,159,
    240,66,1619
A2  1210 DATA 41,127,201,16,240,
    11,152,41,13,201,8,240,4,152
    ,41,227,1715
5C  1220 DATA 168,152,160,3,10,1
    44,2,9,1,136,208,248,201,24,
    176,1,1643
8E  1230 DATA 96,233,40,201,32,1
    44,249,233,8,201,40,144,243,
    233,40,201,2338
F4  1240 DATA 48,144,237,233,56,
    201,56,144,231,233,12,201,60
    ,144,225,169,2394
D6  1250 DATA 59,96,152,160,5,74
    ,136,208,252,105,60,96,64,2,
    69,3,1541
A3  1260 DATA 208,8,64,9,48,34,6
    9,51,208,8,64,9,64,2,69,51,9
    66
00  1270 DATA 208,8,64,9,64,2,69
    ,179,208,8,64,9,0,34,68,51,1
    045
5E  1280 DATA 208,140,68,0,17,34
    ,68,51,208,140,68,154,16,34,
    68,51,1325
B0  1290 DATA 208,8,64.9,16,34,6
    8,51,208,8,64,9,98,19,120,16
    9,1153
A5  1300 DATA 0,33,129,130,0,0,8
    9,77,145,146,134,74,133,157,
    44,41,1332
3D  1310 DATA 44,35,40,36,89,0,8
    8,36,36,0,160,0,177,251,32,8
    ,1032
0D  1320 DATA 135,72,160,0,177,2
    51,32,11,133,32,120,132,204,
    28,2,240,1729
2D  1330 DATA 3,200,208,240,192,
    2,240,12,32,120,132,32,120,1
    32,32,120,1817
10  1340 DATA 132,200,208,240,10
    4,168,162,3,185,192,132,141,
    11,2,185,128,2193
79  1350 DATA 132,141,12,2,169,0
    ,160,5,14,12,2,46,11,2,42,13
    6,886
A0  1360 DATA 208,246,105,63,32,
    210,255,202,208,234,32,120,1
    32,165,255,240,2707
F0  1370 DATA 63,172,28,2,162,3,
    6,255,144,14,189,224,135,32,
    210,255,1894
D6  1380 DATA 189,230,135,240,3,
    32,210,255,202,208,235,165,2
    55,201,232,177,2969
42  1390 DATA 251,176,32,32,11,1
    33,136,208,242,162,3,6,255,1
    44,14,189,1994
3B  1400 DATA 221,135,32,210,255
    ,189,227,135,240,3,32,210,25
    5,202,208,235,2789
A0  1410 DATA 76,123,132,164,252
    ,170,16,1,136,232,208,1,200,
    138,101,251,2201
76  1420 DATA 144,1,200,72,152,3
    2,11,133,104,32,11,133,76,12
    3,132,0,1356
0D  1430 DATA 32,2,137,132,251,1
    33,252,169,0,133,253,133,254
    ,32,121,0,2034
E9  1440 DATA 240,7,32,7,137,132
    ,253,133,254,169,22,133,99,3
    2,123,132,1905
11  1450 DATA 32,0,133,32,120,13
    2,32,234,135,56,173,28,2,101
    ,251,133,1594
5E  1460 DATA 251,144,2,230,252,
    198,99,240,21,32,225,255,240
    ,13,56,165,2423
E4  1470 DATA 253,229,251,165,25
    4,240,217,229,252,176,213,96
    ,0,0,165,254,2994
50  1480 DATA 240,249,32,228,255
    ,240,251,208,192,165,122,208
    ,2,198,123,198,2911
FE  1490 DATA 122,96,138,72,76,1
    2,137,138,72,32,253,174,32,1
    38,173,32,1697
52  1500 DATA 251,183,164,20,104
    ,170,165,21,96,32,249,136,32
    ,160,137,132,2052
75  1510 DATA 251,133,252,169,0,
    133,255,32,160,137,240,3,76,
    8,175,152,2176
23  1520 DATA 164,255,145,251,23
    0,255,192,7,208,237,32,115,0
    ,208,251,240,2790
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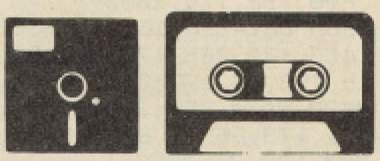
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13  1530 DATA 87,0,32,158,173,32
    ,163,182,234,201,16,176,223,
    166,34,164,2041
45  1540 DATA 35,32,189,255,32,2
    41,183,138,160,1,32,186,255,
    32,7,137,1915
10  1550 DATA 132,253,133,254,32
    ,7,137,166,20,168,169,253,32
    ,216,255,144,2371
A2  1560 DATA 38,76,249,224,0,32
    ,158,173,32,163,182,234,201,
    16,176,172,2126
CD  1570 DATA 166,34,164,35,32,1
    89,255,32,241,183,138,160,1,
    32,186,255,2103
2B  1580 DATA 169,0,32,213,255,1
    76,218,96,104,104,108,2,3,0,
    0,0,1480
D8  1590 DATA 169,0,133,98,133,9
    9,162,4,6,98,38,99,202,208,2
    49,5,1703
61  1600 DATA 98,133,98,32,244,1
    34,32,45,133,176,235,164,98,
    165,99,96,1982
4E  1610 DATA 169,208,141,8,3,16
    9,138,141,9,3,138,240,3,76,1
    39,227,1812
F3  1620 DATA 76,161,142,0,0,0,0
    ,0,166,122,160,4,202,200,232
    ,189,1654
B6  1630 DATA 0,2,240,6,16,38,20
    1,255,208,244,153,251,1,185,
    251,1,2052
8E  1640 DATA 240,120,201,131,24
    0,4,201,143,208,227,133,8,20
    0,232,189,0,2477
3F  1650 DATA 2,153,251,1,240,22
    8,197,8,208,242,240,209,201,
    32,240,218,2670
41  1660 DATA 133,8,201,34,208,5
    ,153,251,1,240,225,201,63,20
    8,4,169,2104
BA  1670 DATA 153,208,199,169,16
    0,133,123,169,158,133,122,13
    2,17,134,15,160,2185
D2  1680 DATA 0,132,11,240,2,232
    ,200,189,0,2,56,241,122,240,
    246,201,2114
E8  1690 DATA 128,208,7,164,17,5
    ,11,208,161,200,177,122,16,2
    51,230,11,1916
5C  1700 DATA 165,11,201,76,176,
    4,166,15,144,220,208,28,169,
    9,133,122,1847
95  1710 DATA 169,128,133,123,16
    6,15,160,255,208,204,153,253
    ,1,133,8,169,2278
97  1720 DATA 255,133,122,169,1,
    133,123,96,201,107,144,218,1
    66,15,164,17,2064
90  1730 DATA 189,0,2,76,234,137
    ,48,3,76,243,166,201,255,240
    ,249,36,2155
A8  1740 DATA 15,48,245,56,233,1
    27,170,132,73,160,255,202,24
    0,12,200,192,2360
6A  1750 DATA 254,176,21,185,158
    ,160,16,246,48,241,200,185,1
    58,160,16,3,2227
CF  1760 DATA 76,239,166,32,71,1
    71,208,242,160,255,202,240,8
    ,200,185,9,2464
71  1770 DATA 128,16,250,48,245,
    200,185,9,128,48,229,32,71,1
    71,208,245,2213
04  1780 DATA 32,115,0,32,217,13
    8,76,174,167,208,3,76,43,168
    ,233,128,1810
8E  1790 DATA 176,3,76,165,169,2
    01,35,176,13,10,168,185,13,1
    60,72,185,1807
55  1800 DATA 12,160,72,76,115,0
    ,233,76,176,20,201,224,208,1
    3,32,115,1733
48  1810 DATA 0,160,5,217,213,12
    8,240,23,136,16,248,76,8,175
    ,201,28,1874
B7  1820 DATA 176,249,10,168,185
    ,146,128,72,185,145,128,72,7
    6,115,0,152,2007
2D  1830 DATA 105,27,144,238,169
    ,128,133,32,169,0,133,31,141
    ,32,208,141,1831
F9  1840 DATA 33,208,168,162,64,
    177,31,145,31,200,208,249,23
    0,32,202,208,2348
EA  1850 DATA 244,96,142,22,208,
    32,163,253,32,80,253,32,21,2
    53,32,72,1935
11  1860 DATA 155,32,36,139,88,1
    62,11,189,102,139,157,0,3,20
    2,16,247,1678
A4  1870 DATA 32,114,139,76,151,
    227,192,137,131,164,216,137,
    134,138,208,138,2334
BB  1880 DATA 184,133,173,2,221,
    9,3,141,2,221,173,0,221,41,2
    52,141,1917
B2  1890 DATA 0,221,169,25,141,2
    4,208,169,4,141,130,2,169,19
    6,141,136,1876
08  1900 DATA 2,206,14,220,165,1
    ,41,251,133,1,169,208,133,32
    ,169,224,1969
D1  1910 DATA 133,34,169,0,133,3
    1,133,33,168,162,16,177,31,1
    45,33,200,1598
42  1920 DATA 208,249,230,32,230
    ,34,202,208,242,165,1,9,4,13
    3,1,169,2117
D8  1930 DATA 226,141,22,3,169,1
    39,141,23,3,169,101,141,20,3
    ,169,145,1615
64  1940 DATA 141,21,3,238,14,22
    0,96,32,188,246,32,225,255,2
    40,3,76,2030
04  1950 DATA 114,254,32,21,253,
    32,163,253,32,24,229,32,36,1
    39,32,62,1708
1B  1960 DATA 155,76,123,227,32,
    2,137,208,1,96,162,14,108,0,
    3,32,1376
AD  1970 DATA 244,139,192,16,176
    ,244,192,8,144,240,152,170,1
    69,46,32,210,2374
3F  1980 DATA 255,169,15,168,32,
    186,255,169,0,32,189,255,32,
    192,255,32,2236
85  1990 DATA 207,255,201,46,240
    ,249,162,14,221,58,140,240,2
    6,202,16,248,2525
B2  2000 DATA 169,63,32,210,255,
    32,215,170,208,210,66,67,73,
    78,82,83,2013
88  2010 DATA 86,85,88,77,36,72,
    13,224,8,208,6,169,15,32,195
    ,255,1569
23  2020 DATA 96,176,30,72,162,1
    5,32,201,255,104,32,210,255,
    160,0,32,1832
E3  2030 DATA 207,255,32,210,255
    ,201,13,240,3,200,208,243,32
    ,204,255,240,2798
E1  2040 DATA 155,224,11,144,38,
    8,162,15,32,198,255,40,208,2
    23,32,215,1960
FF  2050 DATA 170,160,12,32,207,
    255,32,11,133,32,120,132,136
    ,208,244,32,1916
E1  2060 DATA 215,170,166,145,16
    ,214,232,240,249,208,230,224
    ,9,240,93,162,2813
0B  2070 DATA 0,157,0,2,232,32,2
    07,255,201,13,208,245,32,210
    ,255,138,2187
2D  2080 DATA 162,0,160,2,32,189
    ,255,165,20,170,160,0,32,186
    ,255,32,1820
87  2090 DATA 192,255,166,20,32,
    198,255,32,207,255,32,207,25
    5,32,207,255,2600
E7  2100 DATA 32,207,255,165,144
    ,240,8,165,20,32,195,255,76,
    108,140,32,2074
75  2110 DATA 207,255,170,32,207
    ,255,32,205,189,32,207,255,3
    2,210,255,208,2751
11  2120 DATA 248,32,215,170,165
    ,145,201,223,240,250,208,209
    ,72,162,15,32,2587
A3  2130 DATA 201,255,104,32,210
    ,255,32,207,255,201,32,208,2
    46,32,207,255,2732
D1  2140 DATA 32,45,133,144,199,
    10,10,10,10,133,31,32,207,25
    5,32,45,1328
BD  2150 DATA 133,144,185,5,31,3
    2,210,255,76,13,141,32,244,1
    39,152,157,1949
2C  2160 DATA 167,2,32,121,0,240
    ,6,32,253,174,202,16,238,96,
    189,167,1935
85  2170 DATA 2,10,10,10,10,133,
    31,202,189,167,2,41,15,5,31,
    96,954
F0  2180 DATA 162,3,32,43,141,24
    0,33,32,2,137,152,70,21,106,
    70,21,1265
16  2190 DATA 106,70,21,106,141,
    22,212,152,41,7,141,21,212,2
    34,234,234,1954
32  2200 DATA 162,1,32,62,141,14
    1,23,212,162,3,32,62,141,141
    ,24,212,1551
44  2210 DATA 96,32,244,139,192,
    3,176,13,185,152,141,133,32,
    169,212,133,2052
DC  2220 DATA 33,32,253,174,96,7
    6,250,139,0,7,14,32,129,141,
    162,3,1541
C0  2230 DATA 32,43,141,240,240,
    32,2,137,72,152,160,2,145,32
    ,200,104,1734
4A  2240 DATA 145,32,162,3,160,5
    ,32,62,141,145,32,200,202,16
    ,247,96,1680
31  2250 DATA 32,129,141,32,2,13
    7,72,152,160,0,145,32,200,10
    4,145,32,1515
B6  2260 DATA 32,121,0,240,38,32
    ,253,174,162,2,32,43,141,162
    ,2,32,1466
A1  2270 DATA 62,141,160,4,9,1,1
    45,32,72,202,165,32,41,3,73,
    1,1143
3E  2280 DATA 168,189,167,2,153,
    52,3,104,153,55,3,96,162,3,1
    89,52,1551
C3  2290 DATA 3,240,17,222,52,3,
    208,12,189,151,141,168,189,5
    5,3,41,1694
90  2300 DATA 254,153,4,212,202,
    208,231,76,49,234,0,32,244,1
    39,140,32,2210
D7  2310 DATA 208,96,32,244,139,
    140,134,2,96,169,16,160,0,14
    5,43,200,1824
D1  2320 DATA 145,43,32,51,165,1
    65,34,105,2,133,45,165,35,10
    5,0,133,1358
6D  2330 DATA 46,76,96,166,169,3
    ,32,251,163,165,123,72,165,1
    22,72,165,1886
19  2340 DATA 58,72,165,57,72,16
    9,226,72,76,174,167,169,0,44
    ,169,1,1691
B9  2350 DATA 133,31,32,158,173,
    169,255,133,74,32,138,163,15
    4,201,226,240,2312
EF  2360 DATA 5,162,0,108,0,3,16
    5,31,208,14,165,97,240,14,10
    4,104,1420
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1F  2370 DATA 104,104,104,104,10
    4,76,174,167,165,97,240,242,
    104,104,133,57,2079
B2  2380 DATA 104,133,58,104,133
    ,122,104,133,123,76,73,142,2
    55,255,255,255,2325
65  2390 DATA 255,169,103,133,34
    ,169,128,133,35,76,71,164,8,
    169,10,133,1790
8D  2400 DATA 49,133,53,169,0,13
    3,50,133,54,40,240,19,32,2,1
    37,132,1376
83  2410 DATA 49,133,50,32,121,0
    ,240,7,32,7,137,132,53,133,5
    4,32,1212
0A  2420 DATA 142,166,32,51,144,
    32,51,144,208,33,32,108,143,
    32,51,144,1513
4E  2430 DATA 32,51,144,208,3,76
    ,199,144,32,51,144,165,99,14
    5,122,32,1647
E0  2440 DATA 51,144,165,98,145,
    122,32,119,143,240,226,32,51
    ,144,32,51,1795
1B  2450 DATA 144,32,51,144,201,
    34,208,11,32,51,144,240,197,
    201,34,208,1932
F9  2460 DATA 247,240,238,170,24
    0,188,16,233,162,4,221,62,14
    4,240,5,202,2612
12  2470 DATA 208,248,240,221,16
    5,122,133,59,165,123,133,60,
    32,115,0,176,2200
C7  2480 DATA 211,32,107,169,32,
    138,143,165,60,133,123,165,5
    9,133,122,162,1954
19  2490 DATA 0,160,0,189,0,1,24
    0,17,72,32,115,0,144,3,32,18
    8,1193
98  2500 DATA 143,104,160,0,145,
    122,232,208,234,32,115,0,176
    ,8,32,203,1914
CD  2510 DATA 143,32,121,0,144,2
    48,201,44,240,186,208,152,16
    5,53,133,99,2169
0E  2520 DATA 165,54,133,98,76,1
    42,166,165,99,24,101,49,133,
    99,165,98,1767
8C  2530 DATA 101,50,133,98,32,5
    1,144,208,251,96,32,108,143,
    32,51,144,1674
E9  2540 DATA 32,51,144,208,8,16
    9,0,133,99,133,98,240,14,32,
    51,144,1556
35  2550 DATA 197,20,208,16,32,5
    1,144,197,21,208,12,162,144,
    56,32,73,1573
EB  2560 DATA 188,76,223,189,32,
    51,144,32,119,143,240,209,32
    ,220,143,230,2271
B2  2570 DATA 251,32,15,144,230,
    45,208,2,230,46,96,32,220,14
    3,198,251,2143
90  2580 DATA 32,247,143,165,45,
    208,2,198,46,198,45,96,32,23
    0,143,160,1990
63  2590 DATA 0,132,17,132,251,9
    6,165,122,133,34,165,123,133
    ,35,165,45,1748
DA  2600 DATA 133,36,165,46,133,
    37,96,164,17,200,177,34,164,
    251,200,145,1998
B4  2610 DATA 34,32,40,144,208,1
    ,96,230,34,208,236,230,35,20
    8,232,164,2132
8F  2620 DATA 17,177,36,164,251,
    145,36,32,40,144,208,1,96,16
    5,36,208,1756
FA  2630 DATA 2,198,37,198,36,76
    ,15,144,165,34,197,36,208,4,
    165,35,1550
57  2640 DATA 197,37,96,160,0,23
    0,122,208,2,230,123,177,122,
    96,0,137,1937
09  2650 DATA 138,141,167,127,16
    6,58,232,208,1,96,76,8,175,3
    2,68,144,1837
02  2660 DATA 169,0,133,10,32,21
    2,225,56,165,45,233,2,170,16
    5,46,233,1896
5B  2670 DATA 0,168,165,10,76,11
    7,225,0,32,68,144,32,2,137,1
    33,252,1561
B8  2680 DATA 132,251,32,7,137,1
    33,254,132,253,165,251,133,2
    0,165,252,133,2450
8E  2690 DATA 21,32,19,166,144,4
    3,160,0,177,95,133,34,200,17
    7,95,133,1629
D5  2700 DATA 35,160,0,177,34,14
    5,95,230,95,208,2,230,96,230
    ,34,208,1979
43  2710 DATA 2,230,35,56,165,45
    ,229,34,165,46,229,35,176,22
    9,32,50,1758
31  2720 DATA 142,230,251,208,2,
    230,252,56,165,253,229,251,1
    65,254,229,252,3169
EC  2730 DATA 176,183,162,128,10
    8,0,3,32,50,142,76,194,144,0
    ,8,169,1575
6D  2740 DATA 10,133,255,133,253
    ,169,0,133,254,40,240,17,32,
    244,139,132,2184
92  2750 DATA 255,32,121,0,240,7
    ,32,7,137,133,254,132,253,16
    9,6,141,1919
97  2760 DATA 2,3,169,145,141,3,
    3,120,169,56,141,20,3,169,14
    5,141,1430
39  2770 DATA 21,3,88,76,123,164
    ,164,253,165,254,132,99,133,
    98,169,0,1942
77  2780 DATA 133,13,162,144,56,
    32,73,188,32,221,189,162,0,1
    89,0,1,1595
1B  2790 DATA 240,6,157,119,2,23
    2,208,245,134,198,24,165,253
    ,101,255,133,2472
75  2800 DATA 253,144,2,230,254,
    76,131,164,32,237,246,208,36
    ,169,131,141,2454
57  2810 DATA 2,3,169,164,141,3,
    3,169,101,141,20,3,169,145,1
    41,21,1395
8F  2820 DATA 3,162,0,189,129,16
    3,32,210,255,232,224,7,144,2
    45,32,215,2242
88  2830 DATA 170,76,101,145,0,1
    65,203,197,2,240,75,133,2,20
    1,3,144,1857
D7  2840 DATA 69,201,7,176,65,17
    3,141,2,74,8,165,203,41,3,10
    ,40,1378
32  2850 DATA 105,0,208,24,165,2
    11,56,233,10,176,252,73,255,
    105,1,133,2007
D3  2860 DATA 198,170,169,29,157
    ,119,2,202,16,250,48,26,10,1
    33,203,10,1742
9D  2870 DATA 10,101,203,170,160
    ,0,189,175,2,240,9,153,119,2
    ,232,200,1965
1A  2880 DATA 192,10,144,242,132
    ,198,76,252,141,32,244,139,1
    92,2,144,4,2144
73  2890 DATA 192,9,144,3,76,8,1
    75,136,152,10,133,31,10,10,1
    01,31,1221
11  2900 DATA 170,160,0,32,121,0
    ,240,28,169,34,32,255,174,17
    7,122,240,1954
D6  2910 DATA 19,201,34,240,22,1
    57,175,2,232,200,192,10,144,
    239,32,115,2014
52  2920 DATA 0,208,251,96,152,2
    08,11,157,175,2,96,200,177,1
    22,201,95,2151
BC  2930 DATA 240,3,169,0,44,169
    ,13,157,175,2,232,224,11,176
    ,223,169,2007
23  2940 DATA 0,157,175,2,240,21
    6,32,244,139,192,9,176,20,14
    0,52,3,1797
6C  2950 DATA 96,162,0,189,0,1,2
    40,12,201,69,240,5,232,224,1
    2,144,1827
2C  2960 DATA 242,76,250,139,56,
    169,9,237,52,3,168,72,169,46
    ,153,174,2015
A5  2970 DATA 2,169,48,200,192,1
    0,144,246,104,168,162,0,189,
    0,1,240,1875
D9  2980 DATA 7,201,46,240,3,232
    ,208,244,189,0,1,240,6,232,2
    00,192,2241
19  2990 DATA 10,144,245,202,136
    ,189,0,1,153,174,2,202,16,5,
    169,32,1680
54  3000 DATA 136,16,245,136,16,
    239,96,0,162,4,32,201,255,14
    4,4,170,1856
F4  3010 DATA 108,0,3,173,59,3,7
    4,144,127,169,27,32,210,255,
    169,65,1618
00  3020 DATA 32,210,255,169,8,3
    2,210,255,169,224,133,252,16
    9,0,133,251,2502
06  3030 DATA 169,25,133,253,169
    ,27,32,210,255,169,75,32,210
    ,255,169,64,2247
9F  3040 DATA 32,210,255,169,1,3
    2,210,255,169,40,133,254,120
    ,165,1,41,2087
A6  3050 DATA 253,133,1,160,7,17
    7,251,153,167,2,136,16,248,1
    65,1,9,1879
5B  3060 DATA 2,133,1,88,160,7,1
    62,0,30,167,2,38,255,232,224
    ,8,1509
B2  3070 DATA 208,246,165,255,32
    ,210,255,136,16,236,165,251,
    24,105,8,133,2445
08  3080 DATA 251,144,2,230,252,
    198,254,208,195,169,13,32,21
    0,255,165,145,2723
DE  3090 DATA 16,55,198,253,208,
    158,240,49,32,102,229,169,3,
    170,160,0,2042
21  3100 DATA 32,186,255,169,0,3
    2,189,255,32,192,255,162,3,3
    2,198,255,2247
EC  3110 DATA 32,207,255,32,210,
    255,201,13,208,246,165,145,1
    6,6,165,214,2370
82  3120 DATA 201,24,144,236,169
    ,3,32,195,255,169,27,32,210,
    255,169,64,2185
D7  3130 DATA 32,210,255,76,204,
    255,234,169,224,133,252,169,
    0,133,251,168,2765
EA  3140 DATA 162,31,145,251,200
    ,208,251,230,252,202,208,246
    ,160,63,145,251,3005
1C  3150 DATA 136,16,251,96,32,2
    44,139,192,5,144,3;76,250,13
    9,140,59,1922
7E  3160 DATA 3,152,74,144,90,16
    0,196,132,33,160,0,132,32,17
    0,240,6,1724
99  3170 DATA 32,37,148,140,33,2
    08,32,37,148,152,41,15,133,3
    1,32,37,1256
B6  3180 DATA 148,152,10,10,10,1
    0,5,31,162,3,160,0,145,32,20
    0,208,1286
93  3190 DATA 251,230,33,202,208
    ,246,145,32,200,192,232,144,
    249,172,59,3,2598
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85   3200 DATA 192,1,240,22,32,37
     ,148,152,160,216,132,33,160,
     0,162,4,1691
FF   3210 DATA 145,32,200,208,251
     ,230,33,202,208,246,169,128,
     234,48,39,72,2445
6A   3220 DATA 32,145,139,32,68,2
     29,32,37,148,140,33,208,104,
     240,23,74,1684
78   3230 DATA 170,32,37,148,140,
     34,208,32,37,148,140,35,208,
     138,240,6,1753
2B   3240 DATA 32,37,148,140,36,2
     08,173,59,3,74,72,173,17,208
     ,41,223,1644
A2   3250 DATA 144,2,9,32,141,17,
     208,104,74,72,173,22,208,41,
     239,144,1630
01   3260 DATA 2,9,16,141,22,208,
     104,74,173,17,208,41,191,144
     ,2,9,1361
46   3270 DATA 64,141,17,208,96,3
     2,7,137,76,247,139,32,244,13
     9,192,4,1775
36   3280 DATA 144,3,32,250,139,1
     52,208,3,76,234,232,192,2,17
     6,21,162,2026
64   3290 DATA 24,32,240,233,189,
     239,236,133,172,181,216,32,2
     00,233,202,208,2770
42   3300 DATA 240,76,255,233,74,
     102,172,162,24,32,240,233,32
     ,36,234,36,2181
80   3310 DATA 172,48,26,160,1,17
     7,209,136,145,209,200,177,24
     3,136,145,243,2427
80   3320 DATA 200,200,192,40,144
     ,239,136,169,32,145,209,208,
     22,160,38,177,2311
4C   3330 DATA 209,200,145,209,13
     6,177,243,200,145,243,136,13
     6,16,241,200,169,2805
F0   3340 DATA 32,145,209,202,16,
     195,96,16,195,96,0,32,244,13
     9,192,40,1849
C3   3350 DATA 176,144,132,249,32
     ,7,137,208,137,56,152,233,20
     0,176,131,73,2243
D8   3360 DATA 255,133,250,41,7,1
     70,164,249,189,218,148,72,16
     5,250,74,74,2459
59   3370 DATA 74,170,32,240,233,
     32,36,234,104,145,209,173,13
     4,2,145,243,2206
B0   3380 DATA 232,169,160,72,224
     ,25,144,234,104,96,160,227,2
     47,248,98,121,2561
4D   3390 DATA 111,100,32,2,137,1
     40,252,3,141,253,3,32,7,137,
     140,254,1744
A7   3400 DATA 3,141,255,3,173,59
     ,3,74,176,99,173,253,3,208,7
     7,173,1873
B4   3410 DATA 255,3,208,72,173,2
     52,3,201,80,176,65,169,49,56
     ,237,254,2253
C9   3420 DATA 3,144,57,74,38,251
     ,170,173,252,3,74,38,251,168
     ,32,240,1968
1E   3430 DATA 233,32,36,234,165,
     251,41,3,170,56,169,0,42,202
     ,16,252,1902
04   3440 DATA 133,251,162,15,177
     ,209,221,77,149,240,3,202,20
     8,248,138,5,2438
F2   3450 DATA 251,170,189,77,149
     ,145,209,173,134,2,145,243,9
     6,32,126,124,2265
F1   3460 DATA 226,123,97,255,236
     ,108,127,225,251,98,252,254,
     160,170,172,255,3009
7C   3470 DATA 3,208,233,169,199,
     237,254,3,144,226,168,138,20
     8,14,173,252,2629
6E   3480 DATA 3,233,64,173,253,3
     ,233,1,176,210,144,12,173,25
     3,3,208,2142
99   3490 DATA 203,173,252,3,201,
     160,176,196,134,253,173,253,
     3,174,252,3,2609
9F   3500 DATA 134,251,133,252,12
     0,165,1,41,253,133,1,165,253
     ,208,77,138,2325
B0   3510 DATA 41,248,133,251,138
     ,41,7,73,7,170,169,1,202,48,
     3,10,1542
52   3520 DATA 208,250,133,254,16
     9,255,133,255,152,41,248,74,
     74,74,170,152,2642
E6   3530 DATA 41,7,24,101,251,13
     3,251,144,2,230,252,24,189,2
     0,150,101,1920
1F   3540 DATA 251,133,251,189,45
     ,150,101,252,133,252,160,0,1
     77,251,37,255,2637
3C   3550 DATA 5,254,145,251,165,
     1,9,2,133,1,88,96,138,41,252
     ,10,1591
58   3560 DATA 133,251,38,252,138
     ,41,3,73,3,170,173,134,2,41,
     3,133,1588
2A   3570 DATA 254,169,3,202,48,8
     ,6,254,10,6,254,10,208,245,7
     3,255,2005
E6   3580 DATA 133,255,208,164,0,
     64,128,192,0,64,128,192,0,64
     ,128,192,1912
35   3590 DATA 0,64,128,192,0,64,
     128,192,0,64,128,192,0,224,2
     25,226,1827
89   3600 DATA 227,229,230,231,23
     2,234,235,236,237,239,240,24
     1,242,244,245,246,3788
E8   3610 DATA 247,249,250,251,25
     2,254,255,0,32,2,137,132,165
     ,133,166,32,2557
4A   3620 DATA 7,137,132,167,133,
     168,160,0,132,177,132,180,56
     ,165,165,237,2148
23   3630 DATA 252,3,133,169,165,
     166,237,253,3,133,170,5,169,
     240,20,165,2283
4D   3640 DATA 170,16,15,73,255,1
     33,170,165,169,73,255,24,105
     ,1,133,169,1926
84   3650 DATA 136,36,200,132,173
     ,160,0,56,165,167,237,254,3,
     133,171,165,2188
9C   3660 DATA 168,237,255,3,133,
     172,5,171,240,20,165,172,16,
     15,73,255,2100
B6   3670 DATA 133,172,165,171,73
     ,255,24,105,1,133,171,136,36
     ,200,132,176,2083
C4   3680 DATA 56,165,169,229,171
     ,165,170,229,172,176,58,32,2
     44,148,56,173,2413
89   3690 DATA 254,3,229,167,133,
     181,173,255,3,229,168,5,181,
     240,120,24,2365
43   3700 DATA 165,177,101,169,13
     3,177,165,180,101,170,133,18
     0,56,165,177,229,2478
15   3710 DATA 171,170,165,180,22
     9,172,144,7,133,180,134,177,
     32,72,151,32,2149
41   3720 DATA 47,151,76,187,150,
     32,244,148,56,173,252,3,229,
     165,133,181,2227
62   3730 DATA 173,253,3,229,166,
     5,181,240,62,24,165,177,101,
     171,133,177,2260
CE   3740 DATA 165,180,101,172,13
     3,180,56,165,177,229,169,170
     ,165,180,229,170,2641
7A   3750 DATA 144,7,133,180,134,
     177,32,47,151,32,72,151,76,2
     45,150,24,1755
70   3760 DATA 173,254,3,101,176,
     141,254,3,173,255,3,36,176,1
     6,3,101,1868
8A   3770 DATA 176,24,105,0,141,2
     55,3,96,24,173,252,3,101,173
     ,141,252,1919
4B   3780 DATA 3,173,253,3,36,173
     ,16,3,101,173,24,105,0,141,2
     53,3,1460
CF   3790 DATA 96,0,0,0,0,173,59,
     3,74,176,6,234,169,73,76,163
     ,1302
14   3800 DATA 142,32,244,139,132
     ,81,32,7,137,240,3,76,250,13
     9,56,169,1879
71   3810 DATA 199,229,20,144,246
     ,133,80,162,3,173,134,2,41,3
     ,133,172,1874
C2   3820 DATA 10,10,5,172,202,20
     8,249,133,172,206,14,220,165
     ,1,41,253,2061
63   3830 DATA 133,1,162,0,154,16
     5,81,41,3,73,3,168,165,81,41
     ,252,1523
DB   3840 DATA 74,74,133,81,170,1
     69,3,136,48,4,10,10,208,249,
     133,82,1584
CA   3850 DATA 134,97,169,0,6,97,
     42,6,97,42,6,97,42,133,98,24
     ,1090
8E   3860 DATA 165,80,41,7,101,97
     ,133,97,165,80,74,74,74,168,
     24,185,1565
58   3870 DATA 20,150,101,97,133,
     97,185,45,150,101,98,133,98,
     160,0,177,1745
9A   3880 DATA 97,208,17,202,48,1
     3,56,165,97,233,8,133,97,176
     ,240,198,1988
FC   3890 DATA 98,208,236,232,134
     ,99,228,81,240,4,169,3,133,8
     2,177,97,2221
0D   3900 DATA 37,82,208,13,6,82,
     6,82,208,244,138,208,214,169
     ,192,208,2097
9E   3910 DATA 14,165,82,74,74,20
     8,8,230,99,169,192,133,100,2
     08,30,133,1919
D3   3920 DATA 100,133,105,37,172
     ,133,82,177,97,37,105,208,54
     ,177,97,5,1719
69   3930 DATA 82,145,97,70,82,70
     ,82,70,105,70,105,208,234,16
     9,192,133,1914
A9   3940 DATA 105,37,172,133,82,
     232,224,40,240,20,165,97,105
     ,8,133,97,1890
E1   3950 DATA 144,2,230,98,177,9
     7,208,207,165,172,145,97,208
     ,231,202,169,2552
5A   3960 DATA 3,208,19,165,105,1
     0,10,208,13,56,165,97,233,8,
     133,97,1530
BE   3970 DATA 176,236,198,98,208
     ,232,133,105,133,82,134,81,1
     32,102,132,101,2283
38   3980 DATA 198,80,165,80,201,
     200,176,98,41,7,201,7,208,12
     ,165,97,1936
55   3990 DATA 233,56,133,97,165,
     98,233,1,133,98,165,97,208,2
     ,198,98,2015
9D   4000 DATA 198,97,165,101,208
     ,18,177,97,37,105,208,22,165
     ,105,72,165,1940
B1   4010 DATA 80,72,138,72,230,1
     01,208,10,177,97,37,105,240,
     4,198,101,1870
B7   4020 DATA 240,4,177,97,240,6
     ,165,105,10,10,208,16,202,48
     ,27,56,1611
```

```
84   4030 DATA 165,97,233,8,133,9
     7,176,2,198,98,169,3,133,105
     ,228,99,1944
CA   4040 DATA 144,8,208,190,197,
     100,144,186,240,184,165,102,
     208,70,133,101,2380
30   4050 DATA 230,80,230,80,165,
     80,201,200,176,58,165,82,133
     ,105,166,81,2232
A9   4060 DATA 230,102,134,97,169
     ,0,6,97,42,6,97,42,6,97,42,1
     33,1300
48   4070 DATA 98,24,165,80,41,7,
     101,97,133,97,165,80,74,74,7
     4,168,1478
72   4080 DATA 24,185,20,150,101,
     97,133,97,185,45,150,101,98,
     133,98,160,1777
9C   4090 DATA 0,76,178,152,186,2
     40,11,104,170,134,81,104,133
     ,80,104,76,1829
A1   4100 DATA 190,151,165,1,9,2,
     133,1,238,14,220,162,253,154
     ,76,174,1943
99   4110 DATA 167,0,32,216,153,1
     73,21,208,37,254,141,21,208,
     173,28,208,2040
76   4120 DATA 37,254,141,28,208,
     32,240,153,152,157,248,199,1
     73,21,208,5,2256
27   4130 DATA 255,141,21,208,32,
     240,153,152,41,1,8,173,29,20
     8,37,254,1953
CE   4140 DATA 40,240,2,5,255,141
     ,29,208,152,41,2,8,173,23,20
     8,37,1564
1F   4150 DATA 254,40,240,2,5,255
     ,141,23,208,32,240,153,152,4
     1,1,74,1861
0E   4160 DATA 173,27,208,5,255,1
     76,2,69,255,141,27,208,32,24
     0,153,152,2123
EE   4170 DATA 157,39,208,32,240,
     153,140,37,208,32,240,153,14
     0,38,208,173,2198
3A   4180 DATA 28,208,5,255,141,2
     8,208,96,32,244,139,192,8,14
     4,3,76,1807
95   4190 DATA 250,139,152,170,56
     ,42,136,16,252,133,255,73,25
     5,133,254,96,2412
C2   4200 DATA 32,121,0,240,6,32,
     253,174,76,244,139,104,104,9
     6,32,216,1869
A1   4210 DATA 153,138,10,170,32,
     7,137,8,173,16,208,37,254,40
     ,240,2,1625
DD   4220 DATA 5,255,141,16,208,1
     52,157,0,208,32,7,137,208,19
     3,152,157,2028
17   4230 DATA 1,208,96,0,32,244,
     139,132,172,32,253,174,32,24
     4,139,132,2030
50   4240 DATA 174,32,253,174,32,
     244,139,132,175,169,254,133,
     103,165,175,141,2495
2C   4250 DATA 254,3,169,0,141,25
     5,3,24,165,174,101,172,141,2
     52,3,169,2026
2C   4260 DATA 0,105,0,141,253,3,
     169,0,133,102,165,172,10,38,
     102,133,1526
3F   4270 DATA 101,32,244,148,173
     ,255,3,208,20,173,254,3,197,
     175,208,13,2207
8A   4280 DATA 230,103,48,9,240,2
     09,166,103,224,2,208,1,96,16
     0,0,56,1855
5A   4290 DATA 173,252,3,229,174,
     133,97,173,253,3,233,0,133,9
     8,5,97,2056
AB   4300 DATA 240,20,165,98,16,1
     5,73,255,133,98,165,97,73,25
     5,24,105,1832
DF   4310 DATA 1,133,97,200,36,13
     6,152,36,103,48,5,73,255,24,
     105,1,1405
32   4320 DATA 133,176,56,160,0,1
     73,254,3,229,175,133,99,173,
     255,3,233,2255
57   4330 DATA 0,133,100,5,99,240
     ,20,165,100,16,15,73,255,133
     ,100,165,1619
DD   4340 DATA 99,73,255,24,105,1
     ,133,99,136,36,200,152,36,10
     3,48,5,1505
7B   4350 DATA 73,255,24,105,1,13
     3,173,56,165,97,229,99,165,9
     8,229,100,2002
4C   4360 DATA 176,38,24,165,101,
     101,97,133,101,165,102,101,9
     8,133,102,56,1693
35   4370 DATA 165,101,229,99,170
     ,165,102,229,100,144,7,133,1
     02,134,101,32,2013
05   4380 DATA 47,151,32,72,151,7
     6,97,154,24,165,101,101,99,1
     33,101,165,1669
8F   4390 DATA 102,101,100,133,10
     2,56,165,101,229,97,170,165,
     102,229,98,144,2094
A6   4400 DATA 7,133,102,134,101,
     32,72,151,32,47,151,76,97,15
     4,169,0,1458
F7   4410 DATA 141,59,3,76,114,13
     9,255,255,169,196,141,136,2,
     76,91,255,2108
01   4420 REM ** READY TO SAVE BA
     SEX.HEX **
6D   4430 PRINT"[CLR,DOWN2]PRESS
     ANY KEY TO SAVE BASEX.HEX"
90   4431 PRINT"[DOWN]ONCE BASEX.
     HEX IS ON YOUR TAPE OR"
D0   4432 PRINT "DISK THIS PROGRA
     M IS NO LONGER NEEDED"
56   4433 PRINT "[DOWN]THE PROGRA
     M BASEX WILL LOAD AND RUN"
4B   4434 PRINT "THE PROGRAM BASE
     X.HEX"
26   4435 PRINT "[DOWN]IF USING T
     APE THEN BASEX.HEX SHOULD BE
     "
90   4436 PRINT "SAVED AFTER BASE
     X."
60   4440 GETK$:IFK$=""THEN4440
3A   4450 POKE43,0:POKE44,128:POK
     E45,255:POKE46,159:SAVE"BASE
     X.HEX",8,1
65   4460 REM ** CHANGE ,8 TO ,1
     FOR TAPE **
```

Autoscroll



PROGRAM: AUTOSCROLL LOAD

```
A1   63010 REM          "AUTOSCROLL
     "
70   63011 REM           ----------

A9   63012 REM          BY D. J. TRI
     PP
3F   63013 REM             10/4/88
93   63014 REM
FD   63015 REM    PROVIDES A SCROL
     LING AREA
37   63016 REM     BETWEEN AN 'UPP
     ER' AND
4D   63017 REM         'LOWER' SCEEN
      LINE.
AF   63018 REM
61   63019 REM       "SYS 52992,UPPE
     R,LOWER"
43   63020 REM          TURNS IT ON
     .
AC   63021 REM
6D   63022 REM             "SYS 53032
     "
4A   63023 REM          TURNS IT OF
     F.
A9   63024 REM
89   63025 REM   ALSO INCLUDES A
     "PRINT AT"
EB   63026 REM            ROUTINE
A6   63027 REM
D5   63028 REM       "SYS 53018,LIN
     E,COLUMN"
B0   63029 REM           TO USE THI
     S.
A3   63030 REM
CA   63031 REM      LINES GO FROM
     1 (TOP)
AF   63032 REM          TO 25 (BOTT
     OM)
A0   63033 REM
C7   63034 REM   COLUMNS GO FROM
     1 (LEFT)
20   63035 REM          TO 40 (RIGH
     T)
BD   63036 REM
BC   63037 REM
0E   63038 :
1E   63039 A0=52992 :LN=63057
AA   63040 CS=0
7C   63041 FOR I=1 TO 8
81   63042 : READ D
2D   63043 : POKE A0,D
FA   63044 : CS=CS+D
CC   63045 : A0=A0+1
83   63046 : IF A0=53243 THEN I=8

BF   63047 NEXT
AB   63048 LN=LN+1
CD   63049 READ RC
2D   63050 IF CS<>RC THEN PRINT"E
     RROR IN LINE"LN:END
0A   63051 IF A0<>53243 THEN 6304
     0
78   63052 :
CF   63053 REM IF USED AS A SUB-R
     OUTINE APPENDED TO A PROGRAM
     , NEXT LINE SHOULD BE:-
FB   63054 REM RETURN
7F   63055 :
C6   63056 END
7D   63057 :
51   63058 DATA 32,96,207,133,251
     ,176,44,196,1135
A3   63059 DATA 251,144,40,240,38
     ,132,252,162,1259
BA   63060 DATA 54,160,207,142,38
     ,3,140,39,783
48   63061 DATA 3,96,32,96,207,13
     3,214,192,973
3C   63062 DATA 40,16,16,132,211,
     76,108,229,828
00   63063 DATA 162,202,160,241,1
     42,38,3,140,1088
B9   63064 DATA 39,3,96,76,72,178
     ,72,138,674
11   63065 DATA 72,152,72,166,252
     ,228,214,16,1172
87   63066 DATA 3,32,109,207,104,
     168,104,170,897
0D   63067 DATA 104,76,202,241,32
     ,121,0,32,808
17   63068 DATA 253,174,32,138,17
     3,32,191,177,1170
3A   63069 DATA 164,101,136,48,21
     4,192,25,96,976
32   63070 DATA 32,76,207,16,206,
```

```
    132,253,32,954
9B  63071 DATA 76,207,165,253,96
    ,165,172,72,1206
62  63072 DATA 165,173,72,165,17
    4,72,165,175,1161
D7  63073 DATA 72,164,252,132,25
    4,230,254,166,1524
3F  63074 DATA 251,202,198,254,2
    32,32,240,233,1642
6D  63075 DATA 228,254,176,12,18
    9,241,236,133,1469
1E  63076 DATA 172,181,218,32,20
    0,233,48,236,1320
74  63077 DATA 32,255,233,166,25
    1,181,217,41,1376
99  63078 DATA 127,180,218,16,2,
    9,128,149,829
CF  63079 DATA 217,232,228,254,2
    08,239,181,217,1776
D3  63080 DATA 9,128,149,217,166
    ,251,181,217,1318
08  63081 DATA 16,197,166,254,16
    4,211,192,40,1240
4E  63082 DATA 208,6,181,217,41,
    127,149,217,1146
EB  63083 DATA 169,127,141,0,220
    ,173,1,220,1051
B8  63084 DATA 201,251,8,169,127
    ,141,0,220,1117
76  63085 DATA 40,208,11,160,0,2
    34,202,208,1063
65  63086 DATA 252,136,208,249,1
    32,198,166,254,1595
D9  63087 DATA 160,0,24,32,240,2
    55,104,133,948
6E  63088 DATA 175,104,133,174,1
    04,133,173,104,1100
79  63089 DATA 133,172,96,401
```

PROGRAM: AUTOSCROLL DEMO

```
04  100 REM     "AUTOSCROLL DEMO
    "
E1  110 REM
6E  120 REM           BY
47  130 REM      DEREK J TRIPP
CC  140 REM          9/4/88
19  150 REM
2F  160 REM
69  170 REM   DEMONSTRATES USE O
    F "AUTOSCROLL" AND "PRINTAT"
     UTILITIES
3B  180 REM
33  190 REM    **   TRY CHANGING
     'UPPER' AND 'LOWER'    **
37  200 REM    **   IN LINES 280
     AND 290 BELOW, BUT     **
78  210 REM    **  NOTE THAT , I
    F UPPER IS LESS THAN 3 **
6B  220 REM    **       OR LOWER
    IS BIGGER THAN 23       **
25  230 REM    **    THEN YOU'LL
     RUN OUT OF SCREEN!     **
7F  240 REM
EC  250 SCROLL=52992: REM AUTOSC
    ROLL,UPPER,LOWER
A9  260 KILL  =53032: REM TURN O
    FF AUTOSCROLL
08  270 PRNTAT=53018: REM PRINT
    AT,LINE,COLUMN
F9  280 UPPER = 5   :
               REM**   TOP OF SCR
    OLL AREA  **
43  290 LOWER = 20  :
               REM** BOTTOM OF SCR
    OLL AREA  **
17  300 :
18  310 IF PEEK(SCROLL+1)=96 AND
     PEEK(SCROLL+2)=207 THEN 380

7B  320 :
99  330 REM IF THE BASIC LOADER
    IS APPENDED TO THE END OF TH
    IS PROGRAM, THEN USE:-
AF  340 REM GOSUB 63039
0F  350 REM IF YOU HAVE AN M/C F
    ILE OF "AUTOSCROLL" ON DISK,
     USE:-
89  360 REM LOAD"AUTOSCROLL",8,1

49  370 :
BF  380 DEG=180/3.14159265
71  390 DEF FNR(X)=INT(10000*X+.
    5)/10000
E0  400 PRINT"[CLR]";
64  410 SYS PRNTAT,UPPER-2,1
D3  420 PRINT"  ANGLE","  SINE",
    "  COSINE"
17  430 FOR I=1 TO 40:PRINT"-";:
    NEXT
2B  440 SYS PRNTAT,LOWER+1,1
6B  450 FOR I=1 TO 40:PRINT"-";:
    NEXT
64  460 SYS PRNTAT,LOWER+2,5
14  470 PRINT"[RVSON]* PRESS 'CT
    RL' TO SLOW SCROLL *[RVSOFF]
    ";
81  480 SYS PRNTAT,UPPER,1
A5  490 SYS SCROLL,UPPER,LOWER
EC  500 FOR I=0 TO 1 STEP .01
D3  510 : PRINT FNR(DEG*I),
94  520 : PRINT FNR(SIN(I)),
AB  530 : PRINT FNR(COS(I))
F6  540 NEXT:PRINT"[DOWN] DEMO O
    VER: PRESS ANY KEY TO END[DO
    WN3,UP3]":GOSUB 570
F6  550 SYS KILL
B2  560 END
A1  570 : GET Q$:IF Q$="" THEN 5
    70
C8  580 RETURN
```

Balance Sheet

PROGRAM: LISTING 1

```
B2  0 POKE808,234
89  6 REM
49  7 REM BASIC LISTING (1) ** M
    AIN PROGRAM **
87  8 REM
8D  10 REM   *******************
    ******************************
    *************
B8  11 REM   *

                  *
8B  15 REM   *
     BALANCE  SHEET V1.3
                  *
B8  20 REM   *

                  *
B9  25 REM   *
      BY  STUART DAVIS
                  *
C5  30 REM   *

                  *
B8  35 REM   *
          (C) 1988
                  *
97  40 REM   *

                  *
E2  45 REM   *******************
    ******************************
    *************
6F  50 IFPEEK(20000)<>12THENPOKE
    20000,12:SYS52248,2,"D",8
90  100 POKE53265,11:POKE53280,0
    :POKE53281,2:POKE53272,31:PO
    KE646,1:POKE198,0
79  101 POKE53211,160+44
1E  105 SS=52248:LP=5:SC=53265:B
    A=53281:BD=53280:S=54272:PRI
    NTCHR$(8)"[CLR]";
72  107 DIML$(40),D$(12),Z$(30),
    ZZ$(30),BL(30),BL$(30)
3F  109 POKESC,27
44  110 SYSSS,6,1,0,0,0:FORL=1TO
    3000:NEXT:POKES+1,45:POKES,1
    50:POKES+6,240
66  111 HD$=":  DATE  :WITHDRAWN
    :PAID IN: BALANCE:"
D9  112 LI$="[CJ]#######%######
    ###%#######%########[CL]"
E3  113 LO$="[CY]$$$$$$$$&$$$$$$
    $$$&$$$$$$$$&$$$$$$$$[CU]"
4B  114 PD$="*  DATE  *[SPC15]DE
    TAILS[SPC16]*WITHDRAWN*PAID
    IN*"
63  115 PD$=PD$+"BALANCE *"
F1  116 POKES+24,10:POKEBA,6
29  120 IFYR$=""THEN130
40  125 GOTO150
5E  130 SYSSS,6,2,5,16,0
B1  135 Z=17:GOSUB1060:Q=4:PR=1:
    T=26:GOSUB1000:YR$=K$
23  150 POKE198,0:SYSSS,6,4,4,1,
    0:POKEBD,0:POKEBA,6:POKESC,2
    7
D4  155 PRINT"[HOME]";:PRINTTAB(
    31)"[DOWN3,S*]"
23  160 TP=1175:BT=1815:G=TP:GOS
    UB2000
2D  165 IFG=1175THEN450
56  170 IFG=1255THEN400
57  175 IFG=1335THEN250
AE  180 IFG=1415THEN530
2E  185 IFG=1495THEN500
27  190 IFG=1575THEN840
AB  195 IFG=1655THEN730
9D  200 IFG=1735THEN600
7B  201 GOSUB205
D5  202 IFPEEK(197)=25THENPOKE19
    8,0:SYS64760
2E  203 IFPEEK(197)<>25THEN150
CB  205 SYSSS,6,5,3,10,0:LP=300:
    GOSUB1050:LP=5
2E  210 POKEBA,2:IFPEEK(197)=39T
    HEN150
C5  211 POKEBA,6
9C  215 IFPEEK(197)=64THEN210
56  216 RETURN
1A  249 REM ENTER DATA
73  250 F=F+1:PI=0:WT=0
B4  252 POKE198,0:SYSSS,6,15,0,0
    ,0:PO=0
FA  255 Z=2:GOSUB1060:POKE1125,6
    4:PR=1:T=10:Q=8:GOSUB1000:DT
    $=K$:POKE1125,32
CD  260 Z=6:GOSUB1060:POKE1205,6
    4:POKE198,0:Q=38:T=1:PO=2:GO
    SUB1000:DE$=K$
A4  261 POKE1205,32
0B  262 IFLEN(DE$)=38THEN280
4E  270 Y=LEN(DE$):X=38-Y
85  275 FORJ=1TOX:DE$=DE$+CHR$(3
    2):NEXT
3C  280 POKE198,0:PRINT"[DOWN]":
    POKE1365,64:Q=7:T=12:GOSUB10
    00:PI$=K$:POKE1365,32
FC  285 IFPI$=""THENPI$="[SPC3]0
    .00":PRINTTAB(12)PI$:GOTO295

B4  290 QQ$=LEFT$(PI$,4):WW$=RIG
    HT$(PI$,2):EE$=QQ$+WW$:PI=VA
```

```
   L(EE$):PRINT
28 295 POKE1445,64:PRINT"[DOWN]
   ";:GOSUB1000:WT$=K$:POKE1445
   ,32
47 300 IFWT$=""THENWT$="[SPC3]0
   .00":PRINTTAB(12)WT$:GOTO310
A9 305 QQ$=LEFT$(WT$,4):WW$=RIG
   HT$(WT$,2):EE$=QQ$+WW$:WT=VA
   L(EE$):PRINT
AE 310 PRINTTAB(25)"[DOWN,CYAN]
   CORRECT? Y/N[WHITE,UP]"
6D 311 POKE198,0
6F 315 IFPEEK(197)=39THENPI=0:W
   T=0:F=F-1:GOTO150
87 320 IFPEEK(197)<>25THEN315
32 325 BL(F)=(BL(F-1)+PI-WT)
CA 330 BL$(F)=STR$(BL(F))
F9 335 IFBL(F)>999999THENBL(F)=
   0:F=F-1:LP=500:GOSUB1050:LP=
   5:GOTO150
6F 340 GOSUB700
69 345 PRINTTAB(12)BL$(F)
D8 350 SYSSS,6,3,6,8,0
D3 351 POKE198,0:::
AB 355 IFPEEK(197)=64THEN355
6C 360 Z$(F)="[CB]"+DT$+"[RVSON
   ]@[RVSOFF] "+WT$+" [RVSON]@[
   RVSOFF]"+PI$+"[RVSON]@[RVSOF
   F]"+BL$(F)+"[CV]"
A5 365 ZZ$(F)="*"+DT$+"*"+DE$+"
   * "+WT$+" *"+PI$+"*"+BL$(F)+
   "*"
4E 370 GOTO150
40 399 REM SAVE
EB 400 IFF<1THENLP=300:GOSUB105
   0:LP=5:GOTO150
53 405 POKE198,0:SYSSS,6,7,0,0,
   0:PRINT"[HOME,DOWN2]";:PO=0:
   Q=3:T=23:GOSUB1000
BB 410 NM$="@:"+K$+"FILE-"+YR$+
   ",S,W"
AF 420 OPEN15,8,15:OPEN5,8,5,NM
   $:GOSUB800
91 425 PRINT#5,F
01 430 FORJ=1TOF:PRINT#5,Z$(J):
   PRINT#5,ZZ$(J):NEXT
D6 435 PRINT#5,BL(F)
51 440 CLOSE5:GOSUB800:CLOSE15
8D 445 GOTO150
75 449 REM LOAD
13 450 POKE198,0:SYSSS,6,6,3,19
   ,0
F8 452 Z=21:GOSUB1060:Q=3:T=26:
   GOSUB1000
9D 455 NM$=K$+"FILE-"+YR$+",S,R
   "
58 460 OPEN15,8,15:OPEN5,8,5,NM
   $
7B 461 GOSUB800
19 465 INPUT#5,F:FORJ=1TOF:INPU
   T#5,Z$(J):INPUT#5,ZZ$(J):NEX
   TJ
BD 470 INPUT#5,BL(F)
5E 475 CLOSE5:GOSUB800:CLOSE15
DC 480 GOTO150
F3 499 REM VIEW SHEET
B7 500 IFF<1THENLP=300:GOSUB105
   0:LP=5:GOTO150
91 501 SYSSS,5,16,0,0,40,25
FF 504 POKESC,11::POKEBA,0:PRIN
   T"[CLR]";:POKESC,27
19 505 PRINTTAB(1)HD$:PRINTTAB(
   1)LI$
E2 510 FORP=1TOF:PRINTTAB(1)Z$(
   P):IFPEEK(197)<>64THENGOSUB5
   24
2A 515 NEXT:PRINTTAB(1)LO$
C8 516 IFPEEK(197)=64THEN516
F6 518 POKESC,11::::SYSSS,6,16,
   0,0,0:SYSSS,4,16:GOTO150
B5 521 GOTO520
F1 524 POKE198,0:IFPEEK(197)=64
   THENRETURN
BD 525 GOTO524
F0 529 REM WIPE SHEET
3A 530 SYSSS,6,14,2,7,0
8F 535 Z=9:GOSUB1060:Q=3:T=25:G
   OSUB1000
4E 540 GOSUB205:IFPEEK(197)=39T
   HEN150
FA 545 NM$="S:"+K$+"FILE-"+YR$
32 550 OPEN15,8,15,NM$:GOSUB800
   :CLOSE15:GOTO150
3F 599 REM READ DIRECTORY
50 600 SYSSS,6,9,0,0,0:V=1:D=0
90 605 PRINT"[HOME,DOWN2]";TAB(
   7);YR$:POKE646,6
DF 610 OPEN1,8,0,"$:???FILE-"+Y
   R$
22 615 GET#1,X$,X$
CF 616 GET#1,X$,X$,X$,X$:D=0
BC 617 IFSTTHENCLOSE1:GOTO640
AA 620 GET#1,X$:IFX$=""THENPRIN
   T:GOTO616
86 621 IFX$=CHR$(34)THENQ=NOTQ
6D 622 IFD=16THENPOKE646,1
23 623 IFX$="K"THENPOKE646,6
B9 625 IFQANDD>3ANDD<16THENPRIN
   TTAB(4);X$;
61 626 D=D+1
45 630 GOTO620
A8 640 SYSSS,6,3,11,16,0
9A 651 POKE198,0:POKE646,1
5F 655 IFPEEK(197)=64THEN655
95 660 GOTO150
F8 670 PRINTTAB(5);D$(V):RETURN
50 700 AA$=RIGHT$(BL$(F),2):NN=
   LEN(BL$(F))
C3 701 IFNN<4THEN715
DF 702 IFNN=4THENSS$=LEFT$(BL$(
   F),2):BL$(F)="[SPC3]"+SS$+".
   "+AA$
9B 704 IFNN=5THENSS$=LEFT$(BL$(
   F),3):BL$(F)="  "+SS$+"."+AA
   $
E3 706 IFNN=6THENSS$=LEFT$(BL$(
   F),4):BL$(F)=" "+SS$+"."+AA$
8D 708 IFNN=7THENSS$=LEFT$(BL$(
   F),5):BL$(F)=SS$+"."+AA$
44 712 RETURN
34 715 IF LEFT$(AA$,1)=CHR$(32)
   THENBL$(F)="[SPC4]0.0"+RIGHT
   $(AA$,1):RETURN
CD 720 BL$(F)="[SPC4]0."+AA$
59 725 RETURN
C9 729 REM RENAME SHEET
5D 730 SYSSS,6,8,18,0,0
65 735 PRINT"[HOME,DOWN2]";:T=3
   5:Q=3:GOSUB1000:U$=K$:PRINT:
   GOSUB1000:I$=K$
EA 740 NM$="R:"+I$+"FILE-"+YR$+
   "="+U$+"FILE-"+YR$
2F 745 OPEN15,8,15,NM$:GOSUB800
   :CLOSE15:GOTO150
59 800 INPUT#15,X,X$
7F 805 IFX<20THENRETURN
B1 810 CLOSE5:CLOSE15:POKEBA,2:
   SYSSS,6,10,2,17,0
ED 815 Z=19:GOSUB1060:PRINTTAB(
   3);X$
95 820 LP=800:GOSUB1050:LP=10
F4 821 SYSSS,6,3,5,20,0
E7 825 IFPEEK(197)=64THEN825
FC 830 GOTO150
DF 839 REM PRINT SHEET
6D 840 IFF<1THENLP=300:GOSUB105
   0:LP=5:GOTO150
46 841 SYSSS,6,11,15,13,0
7B 845 Z=15:GOSUB1060:PRINTTAB(
   37)"[S*]"
FC 850 TP=1661:BT=1901:G=TP:GOS
   UB2000
A9 855 IFG=TPTHEN150
AC 856 IFG=1741THENI=1:K=F:GOTO
   900
19 857 IFG=1821THEN950
0B 859 REM CHANGE PRINT FORMAT
5A 860 SYSSS,6,12,14,10,0
4E 861 GOSUB892
58 865 Z=12:GOSUB1060:PRINTTAB(
   35)"[S*]"
DA 866 TP=1539:BT=1939:G=TP
6D 867 GOSUB2000
A2 870 IFG=TPTHEN840
D2 872 IFG=1619ANDPEEK(1599)=32
   THENPOKE1599,125:F(1)=1:GOTO
   867
ED 874 IFG=1619ANDPEEK(1599)=12
   5THENPOKE1599,32:F(1)=0:GOTO
   867
1D 876 IFG=1699ANDPEEK(1679)=32
   THENPOKE1679,125:F(2)=1:GOTO
   867
C4 878 IFG=1699ANDPEEK(1679)=12
   5THENPOKE1679,32:F(2)=0:GOTO
   867
19 880 IFG=1779ANDPEEK(1759)=32
   THENPOKE1759,125:F(3)=1:GOTO
   867
5A 882 IFG=1779ANDPEEK(1759)=12
   5THENPOKE1759,32:F(3)=0:GOTO
   867
AD 884 IFG=1859ANDPEEK(1839)=32
   THENPOKE1839,125:F(4)=1:GOTO
   867
C4 886 IFG=1859ANDPEEK(1839)=12
   5THENPOKE1839,32:F(4)=0:GOTO
   867
7D 888 IFG=1939ANDPEEK(1919)=32
   THENPOKE1919,125:F(5)=1:GOTO
   867
06 890 IFG=1939ANDPEEK(1919)=12
   5THENPOKE1919,32:F(5)=0:GOTO
   867
50 891 GOTO867
A5 892 IFF(1)=1THENPOKE1599,125
22 893 IFF(2)=1THENPOKE1679,125
23 894 IFF(3)=1THENPOKE1759,125
68 895 IFF(4)=1THENPOKE1839,125
69 896 IFF(5)=1THENPOKE1919,125
0B 898 RETURN
F9 900 POKE198,0:OPEN4,4
96 905 IFF(1)=1THENPRINT#4, CHR
   $(27);CHR$(126);CHR$(49)
BC 907 IFF(2)=1THENPRINT#4, CHR
   $(27);"G";
F5 909 IFF(3)=1THENPRINT#4, CHR
   $(27);"E";
56 910 IFF(4)=1THENPRINT#4, CHR
   $(27);CHR$(120);CHR$(49)
E1 912 IFF(5)=1THENPRINT#4, CHR
   $(27);CHR$(120);CHR$(49);:PR
   INT#4, CHR$(27);CHR$(52)
C7 915 PRINT#4, "NUMBER OF RECO
   RDS IS";F
8E 916 IFI>1ORK<FTHENPRINT#4, "
   PRINTED FROM RECORD";I;"TO R
   ECORD";K
BE 920 PRINT#4, CHR$(27);"-";"1
   ";PD$;CHR$(27);"-";"0"
28 921 IFF=1THEN935
95 925 KK=K-1
DC 930 FORJ=ITOKK:PRINT#4, ZZ$(
   J)
0D 933 IFPEEK(197)<>64THENPRINT
   #4 ,CHR$(13);"**BREAK**":CLO
   SE4:GOTO150
2B 934 NEXT
FB 935 PRINT#4, CHR$(27);"-";"1
   ";ZZ$(K);CHR$(27);"-";"0"
93 940 PRINT#4, CHR$(27);"@"
CF 945 CLOSE4:GOTO150
C8 950 POKE198,0:SYSSS,6,13,2,1
   5,0
```

```
A0   955 PO=1:Q=2:T=16:Z=17:GOSUB
     1060:GOSUB1000:I=VAL(K$)
78   960 IFI<1ORI>FTHEN950
33   961 PRINT:GOSUB1000:K=VAL(K$
     )
6F   965 IFK<IORK>FTHEN950
04   970 PO=0:GOTO900
E5   1000 K$="":LO=0
9D   1001 FORL=1TO40:L$(L)="":NEX
     T
EF   1005 FORJ=1TOQ
D3   1020 GETL$(J):IFL$(J)=""THEN
     1020
9C   1021 IFPO=1THEN1041
9C   1022 IFPO=2THEN1043
AD   1023 IFPO=3THEN1046
5D   1024 IFASC(L$(J))=17ORASC(L$
     (J))=29ORASC(L$(J))=145ORASC
     (L$(J))=157THEN1020
C8   1026 IFL$(J)=CHR$(20)THEN105
     1
D3   1027 IFASC(L$(J))<21ORASC(L$
     (J))>95THEN1020
8B   1028 GOSUB1050
A8   1029 IFPR=1THENPRINTTAB(T);L
     $(J);
D7   1030 LO=LO+1
D7   1035 NEXTJ
BC   1036 FORB=1TOLO:K$=K$+L$(B):
     NEXT
9A   1040 RETURN
62   1041 IFASC(L$(J))<48ORASC(L$
     (J))>57THEN1020
24   1042 GOTO1026
27   1043 IFASC(L$(J))=13THENL$(J
     )="":GOTO1036
10   1044 GOTO1024
42   1046 IFASC(L$(J))<42ORASC(L$
     (J))>47THEN1020
12   1047 GOTO1027
C9   1050 POKES+4,17:FORP=1TOLP:N
     EXTP:POKES+4,16:RETURN
BB   1051 IFJ<2THEN1020
56   1055 L$(J-1)="":L$(J)="":PRI
     NT"[LEFT,WHITE]-[LEFT]";:J=J
     -1:LO=LO-1:GOSUB1050:GOTO102
     0
9A   1060 PRINT"[HOME]";:FORL=1TO
     Z:PRINT"[DOWN]";:NEXT:RETURN

DC   2000 POKE198,0
1F   2010 GETK$:IFK$=""THEN2010
D1   2015 GOSUB1050
10   2020 POKE198,0
6F   2030 IFK$="[DOWN]"ANDG=BTTHE
     NPOKEG,32:G=TP:POKEG,64:GOTO
     2010
C9   2040 IFK$="[UP]"ANDG=TPTHENP
     OKEG,32:G=BT:POKEG,64:GOTO20
     10
F1   2050 IFK$="[DOWN]"THENPOKEG,
     32:G=G+80:POKEG,64
CE   2060 IFK$="[UP]"THENPOKEG,32
     :G=G-80:POKEG,64
16   2065 IFK$=CHR$(13)THENRETURN

0C   2070 IFK$="←"THEN130
1F   2071 IFK$="D"ANDF>1THENBL(F)
     =BL(F-1):F=F-1
CE   2072 IFK$=CHR$(137)THENRUN
2D   2075 GOTO2010
```

PROGRAM: LISTING 2

```
41   10 BL=64:LN=50:SA=14333
5B   20 FOR L=0 TO BL:CX=0:FOR D=
     0 TO 15:READ A:CX=CX+A:POKE
     SA+L*16+D,A:NEXT D
A5   30 READ A:IF A><CX THENPRINT
     "ERROR IN LINE";LN+(L*10):ST
     OP
40   40 NEXT L:END
A1   50 DATA 88,96,72,255,0,255,0
     ,255,0,255,0,124,198,198,254
     ,198,2248
B0   60 DATA 198,198,0,252,198,19
     8,252,198,198,252,0,62,96,19
     2,192,192,2678
9E   70 DATA 96,62,0,248,204,198,
     198,198,204,248,0,254,192,19
     2,252,192,2738
15   80 DATA 192,254,0,254,192,19
     2,252,192,192,192,0,62,96,19
     2,206,198,2666
4F   90 DATA 102,62,0,198,198,198
     ,254,198,198,198,0,124,24,24
     ,24,24,1826
52   100 DATA 24,124,0,254,6,6,6,
     198,198,124,0,198,198,204,24
     8,198,1986
59   110 DATA 198,198,0,192,192,1
     92,192,192,192,254,0,252,198
     ,214,214,214,2894
77   120 DATA 214,214,0,124,102,1
     02,102,102,102,102,0,124,198
     ,198,198,198,2080
81   130 DATA 198,124,0,252,198,1
     98,252,192,192,192,0,56,108,
     198,198,206,2564
AF   140 DATA 124,54,0,252,198,19
     8,198,252,204,198,0,124,192,
     192,124,6,2316
D6   150 DATA 6,252,0,254,24,24,2
     4,24,24,24,0,102,102,102,102
     ,102,1166
DC   160 DATA 102,62,0,198,198,19
     8,198,198,124,24,0,214,214,2
     14,214,214,2372
02   170 DATA 214,108,0,198,108,5
     6,56,56,108,198,0,198,198,19
     8,124,24,1844
9E   180 DATA 24,24,0,126,6,12,24
     ,48,96,126,0,63,240,240,63,2
     40,1332
16   190 DATA 240,63,0,124,6,192,
     240,192,192,252,0,240,60,60,
     240,60,2161
B3   200 DATA 60,240,0,255,0,0,7,
     0,0,255,0,240,60,60,240,60,1
     477
62   210 DATA 60,240,0,0,0,0,0,0,
     0,0,0,48,48,48,48,0,492
9B   220 DATA 48,48,0,120,60,30,1
     5,15,30,60,120,255,0,0,255,0
     ,1056
5C   230 DATA 0,0,0,0,0,0,0,255,0
     ,0,255,255,0,0,255,24,1044
AF   240 DATA 24,24,24,24,24,24,2
     4,255,0,0,255,254,0,254,0,25
     4,1440
B6   250 DATA 0,254,0,63,240,240,
     240,63,0,0,0,252,60,60,60,25
     2,1784
82   260 DATA 60,60,0,0,198,108,5
     6,56,108,198,0,24,24,126,126
     ,24,1168
40   270 DATA 24,0,0,0,0,0,0,0,48
     ,48,96,0,0,62,0,0,278
14   280 DATA 0,0,0,0,0,0,0,0,48,
     48,0,3,6,12,24,48,189
D7   290 DATA 96,192,0,124,198,20
     6,214,230,198,124,0,24,56,24
     ,24,24,1734
D0   300 DATA 24,126,0,252,6,24,1
     12,192,224,254,0,252,6,6,60,
     6,1544
FD   310 DATA 6,252,0,204,204,204
     ,126,12,12,12,0,254,192,192,
     252,6,1928
73   320 DATA 6,252,0,124,192,192
     ,252,198,198,124,0,254,6,12,
     24,48,1882
01   330 DATA 96,96,0,124,198,198
     ,124,198,198,124,0,126,198,1
     98,198,126,2202
89   340 DATA 6,6,0,0,48,48,0,48,
     48,0,0,0,48,48,0,48,348
B7   350 DATA 48,96,0,3,15,3,3,3,
     3,63,0,0,0,62,0,62,361
2F   360 DATA 0,0,0,192,192,192,1
     92,192,192,248,0,252,198,6,6
     2,48,1966
BA   370 DATA 0,48,0,3,15,63,255,
     255,63,15,3,63,240,240,255,2
     40,1758
34   380 DATA 240,240,0,240,60,60
     ,252,60,60,60,0,255,240,240,
     255,240,2502
71   390 DATA 240,255,0,240,60,60
     ,240,60,60,240,0,15,60,240,2
     40,240,2250
A1   400 DATA 60,15,0,252,0,0,0,0
     ,0,252,0,255,240,240,240,240
     ,1794
BC   410 DATA 240,255,0,192,240,6
     0,60,60,240,192,0,255,240,24
     0,255,240,2769
05   420 DATA 240,255,0,252,0,0,2
     40,0,0,252,0,255,240,240,255
     ,240,2469
DA   430 DATA 240,240,0,252,0,0,2
     40,0,0,0,0,15,60,240,240,240
     ,1767
1E   440 DATA 60,15,0,252,0,0,252
     ,60,60,252,0,240,240,240,255
     ,240,2166
AF   450 DATA 240,240,0,60,60,60,
     252,60,60,60,0,255,3,3,3,3,1
     359
F7   460 DATA 3,255,0,252,192,192
     ,192,192,192,252,0,255,0,0,0
     ,240,2217
3C   470 DATA 240,63,0,252,60,60,
     60,60,60,240,0,240,240,240,2
     55,240,2310
32   480 DATA 240,240,0,60,60,240
     ,224,60,60,60,0,240,240,240,
     240,240,2444
EE   490 DATA 240,255,0,0,0,0,0,0
     ,0,252,0,255,243,243,243,243
     ,1974
20   500 DATA 243,243,0,240,60,60
     ,60,60,60,60,0,255,240,240,2
     40,240,2301
23   510 DATA 240,240,0,240,60,60
     ,60,60,60,60,0,63,240,240,24
     0,240,2103
27   520 DATA 240,63,0,240,60,60,
     60,60,60,240,0,255,240,240,2
     55,240,2313
32   530 DATA 240,240,0,240,60,60
     ,240,0,0,0,0,15,60,240,240,2
     40,1875
74   540 DATA 63,15,0,192,240,60,
     60,252,240,60,0,255,240,240,
     240,255,2412
47   550 DATA 240,240,0,240,60,60
     ,60,240,240,60,0,63,240,240,
     63,0,2046
31   560 DATA 0,255,0,240,0,0,240
     ,60,60,240,0,255,3,3,3,3,136
     2
0B   570 DATA 3,3,0,252,192,192,1
     92,192,192,192,0,240,240,240
     ,240,240,2610
04   580 DATA 240,63,0,60,60,60,6
     0,60,60,252,0,240,240,240,24
     0,240,2115
6E   590 DATA 63,7,0,60,60,60,60,
     60,240,192,0,243,243,243,243
     ,243,2017
4F   600 DATA 243,60,0,60,60,60,6
     0,60,60,240,0,240,60,15,15,1
     5,1248
E5   610 DATA 60,240,0,60,240,192
     ,192,192,240,60,0,240,240,24
```

```
    0,63,7,2266
30  620 DATA 7,7,0,60,60,60,240,
    128,128,128,0,255,0,0,3,15,1
    091
24  630 DATA 60,255,0,252,60,240
    ,192,0,0,252,0,255,192,192,2
    07,204,2361
33  640 DATA 204,204,204,255,3,3
    ,243,51,51,51,51,204,204,204
    ,204,207,2343
2B  650 DATA 192,192,255,51,51,5
    1,51,243,3,3,255,63,240,207,
    206,206,2269
8C  660 DATA 207,240,63,240,60,2
    04,12,12,204,60,240,248,248,
    255,243,51,2587
C7  670 DATA 51,63,0,255,195,219
    ,219,219,195,255,0,255,255,2
    55,255,255,2946
06  680 DATA 255,255,255,51,51,5
    1,51,51,51,51,51,204,204,204
    ,204,204,2193
85  690 DATA 204,204,204,24,24,2
    4,24,24,24,24,24,0,0,0,0,0,8
    04
```

PROGRAM: LISTING 3

```
31  50 L=52224:E=0:PRINTCHR$(147
    )"PUTTING CODE IN MEMORY"
AC  60 FORX=0TO66:T=0:FORY=0TO14
F1  70 READA:IFA<0ORA>255THEN100
0A  80 POKEL,A:L=L+1:T=T+A:NEXT
47  90 READA:T=T-(INT(T/256)*256
    )
3A  100 IFT<>ATHENPRINT"ERROR IN
     LINE"1000+(X*10)"CHECKSUM I
    SN'T";A:END
96  110 PRINT1000+(X*10)"O.K.-YE
    AH MAN!!":NEXT
4B  120 PRINTCHR$(147):PRINT:PRI
    NT"CODE LOADED"
02  130 END
EC  1000 DATA32,253,174,32,212,2
    25,169,204,133,252,169,0,133
    ,251,169,104
27  1010 DATA251,162,235,160,207
    ,32,216,255,96,32,241,183,13
    8,201,1,106
4D  1020 DATA208,3,76,162,207,20
    1,2,208,3,76,198,207,201,3,2
    08,171
F8  1030 DATA3,76,69,206,201,4,2
    08,3,76,83,206,201,5,208,3,1
    6
49  1040 DATA76,139,206,201,6,20
    8,3,76,46,207,162,1,160,48,1
    40,143
11  1050 DATA126,204,138,201,10,
    144,6,233,10,238,126,204,24,
    105,48,25
22  1060 DATA141,127,204,160,204
    ,169,112,32,30,171,165,58,20
    1,255,240,221
14  1070 DATA3,32,194,189,76,134
    ,227,60,87,73,78,68,79,87,32
    ,139
2A  1080 DATA69,82,82,79,82,32,3
    2,32,62,0,165,1,41,254,133,1
    22
7C  1090 DATA1,96,165,1,9,1,133,
    1,96,169,0,133,251,170,173,1
    19
6A  1100 DATA223,207,10,141,163,
    204,172,224,207,165,251,24,1
    05,0,144,192
0C  1110 DATA1,232,133,251,136,2
    08,243,165,251,24,105,5,144,
    1,232,83
C1  1120 DATA141,225,207,142,226
    ,207,96,173,225,207,24,109,2
    16,207,141,242
40  1130 DATA227,207,169,0,109,2
    26,207,24,109,217,207,141,22
    8,207,205,179
8B  1140 DATA219,207,96,32,130,2
    04,169,160,133,254,169,0,133
    ,253,160,15
85  1150 DATA0,177,253,240,21,20
    5,220,207,240,21,160,3,177,2
    53,72,201
C4  1160 DATA200,177,253,133,254
    ,104,133,253,76,224,204,32,1
    37,204,56,136
FC  1170 DATA96,32,137,204,24,96
    ,32,241,183,142,220,207,138,
    201,0,161
CA  1180 DATA208,7,162,10,104,10
    4,76,72,204,96,32,241,183,14
    2,221,70
22  1190 DATA207,138,201,40,144,
    5,162,4,76,18,205,32,241,183
    ,142,6
E3  1200 DATA222,207,138,201,25,
    144,5,162,5,76,18,205,96,173
    ,221,106
F6  1210 DATA207,24,109,223,207,
    170,202,138,201,40,144,5,162
    ,8,76,124
EE  1220 DATA18,205,173,222,207,
    24,109,224,207,170,202,138,2
    01,25,144,221
9C  1230 DATA5,162,9,76,18,205,9
    6,173,222,207,133,20,169,40,
    133,132
11  1240 DATA21,24,169,0,162,8,1
    06,102,20,144,3,24,101,21,20
    2,83
46  1250 DATA16,245,133,21,165,2
    0,24,109,221,207,144,2,230,2
    1,141,163
4C  1260 DATA229,207,141,231,207
    ,173,218,207,24,101,21,141,2
    30,207,169,202
86  1270 DATA216,24,101,21,141,2
    32,207,96,169,160,133,254,14
    1,217,207,15
0A  1280 DATA169,0,133,253,141,2
    16,207,32,130,204,160,0,177,
    253,240,11
66  1290 DATA46,200,177,253,141,
    223,207,200,177,253,141,224,
    207,32,144,65
E9  1300 DATA204,32,187,204,160,
    3,173,227,207,72,145,253,141
    ,216,207,127
6D  1310 DATA200,173,228,207,145
    ,253,141,217,207,133,254,104
    ,133,253,76,164
94  1320 DATA174,205,32,137,204,
    96,142,248,205,140,249,205,1
    74,224,207,82
7A  1330 DATA173,223,207,141,235
    ,207,160,0,32,0,0,169,40,24,
    101,176
70  1340 DATA251,144,2,230,252,1
    33,251,173,223,207,24,101,25
    3,144,2,86
A2  1350 DATA230,254,133,253,202
    ,208,219,96,177,251,72,177,2
    53,77,234,20
56  1360 DATA207,145,251,104,77,
    234,207,145,253,200,206,235,
    207,208,234,97
AF  1370 DATA96,177,253,77,234,2
    07,145,251,200,206,235,207,2
    08,243,96,19
B2  1380 DATA177,251,145,253,200
    ,206,235,207,208,246,96,169,
    0,141,0,230
4B  1390 DATA160,141,216,207,169
    ,160,141,217,207,96,32,5,205
    ,32,213,153
FC  1400 DATA204,144,5,162,2,76,
    72,204,32,130,204,160,3,177,
    253,36
30  1410 DATA133,251,200,177,253
    ,133,252,160,0,177,251,145,2
    53,230,251,50
A0  1420 DATA208,2,230,252,230,2
    53,208,2,230,254,165,252,205
    ,219,207,101
CE  1430 DATA208,233,32,157,205,
    96,32,5,205,32,24,205,32,241
    ,183,98
98  1440 DATA142,223,207,202,138
    ,201,40,144,5,162,6,76,72,20
    4,32,62
83  1450 DATA241,183,142,224,207
    ,202,138,201,25,144,5,162,7,
    76,72,237
37  1460 DATA204,32,57,205,32,21
    3,204,176,5,162,3,76,72,204,
    32,141
30  1470 DATA144,204,32,187,204,
    144,5,162,11,76,72,204,32,96
    ,205,242
CB  1480 DATA173,216,207,133,253
    ,173,217,207,133,254,160,0,1
    73,220,207,166
3D  1490 DATA145,253,200,173,223
    ,207,145,253,200,173,224,207
    ,145,253,200,185
C1  1500 DATA173,227,207,141,216
    ,207,145,253,200,173,228,207
    ,141,217,207,126
D1  1510 DATA145,253,165,253,24,
    105,5,144,2,230,254,133,253,
    173,229,64
35  1520 DATA207,133,251,173,230
    ,207,133,252,162,58,160,206,
    32,230,205,79
4E  1530 DATA173,231,207,133,251
    ,173,232,207,133,252,32,236,
    205,169,0,74
99  1540 DATA168,145,253,96,32,5
    ,205,32,24,205,32,241,183,13
    8,41,8
E9  1550 DATA128,141,234,207,138
    ,41,64,141,233,207,32,213,20
    4,144,5,84
3F  1560 DATA162,2,76,72,204,32,
    130,204,160,1,177,253,141,22
    3,207,252
E0  1570 DATA200,177,253,141,224
    ,207,32,137,204,32,57,205,32
    ,96,205,154
04  1580 DATA169,5,24,101,253,14
    4,2,230,254,133,253,32,130,2
    04,173,59
66  1590 DATA229,207,133,251,173
    ,230,207,133,252,173,233,207
    ,208,7,162,245
4D  1600 DATA44,160,206,76,142,2
    07,162,21,160,206,32,230,205
    ,173,231,207
B8  1610 DATA207,133,251,173,232
    ,207,133,252,32,236,205,32,1
    37,204,96,226
77  1620 DATA32,253,174,32,212,2
    25,32,130,204,169,160,133,25
    2,169,0,129
AE  1630 DATA133,251,169,251,174
    ,216,207,172,217,207,232,208
    ,1,200,32,110
1E  1640 DATA216,255,32,137,204,
    96,32,253,174,32,212,225,169
    ,0,170,159
9B  1650 DATA160,160,32,213,255,
    32,157,205,96,0,160,4,192,0,
    0,130
2D  1660 DATA0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,0,0
```

PROGRAM: LISTING 4

```
17  0 REM ******LISTING 4******
```

```
8E   1 REM
F3   2 REM ***WINDOWS-CREATOR***
8B   4 REM
AE   8 SYS52248,3
6B   9 POKE53280,0:PRINT"[BLACK,C
     LR]";:GOSUB45
9C   10 POKE53272,31
71   20 PRINTTAB(4)"[WHITE,DOWN2,
     CJ]#########################
     #####[CL]"
B4   21 PRINTTAB(4)"[UP,CB]  [SC,
     SD,SA,SB,SW,SX,SA,SB,S+,C-,S
     E,SF,SI,SJ]  [CG,C+,SO,SP,SI
     ,SJ,SI,SJ,CM,C£]  [CV]"
9E   22 PRINTTAB(4)"[CB]  #######
     ###################  [CV]"
2E   23 PRINTTAB(4)"[UP,CB,SPC12,
     CQ,CD]<>.^←[SPC11,CV]"
46   24 PRINTTAB(4)"[CB,SPC30,CV]
     "
B5   25 PRINTTAB(4)"[UP,CB] [CO,S
     @] [SG,SH,SA,SB,CQ,CD,SQ,SR,
     CG,C+,S-,PI,SK,SL,CM,C£] <>(
     )[]() [CV]"
D2   26 PRINTTAB(4)"[CY]$$$$$$$$$
     $$$$$$$$$$$$$$$$$$$$$[CU]"
2E   29 PRINTTAB(4)"[UP,CJ]######
     ########################[CL]
     "
FB   30 PRINTTAB(4)"[CB,C*,SSPC,C
     T,C@,S-,PI,SM,SN,CT,C@,SA,SB
     ,SY,SZ]  [CZ,CS,CT,C@,SQ,SR,
     CM,C£,CM,C£,SI,SJ,S+,C-,CV]"
2A   31 PRINTTAB(4)"[UP,CB,SPC30,
     CV]"
90   32 PRINTTAB(4)"[CB,SPC13,SC,
     SD,CE,CR,SPC13,CV]"
50   33 PRINTTAB(4)"[UP,CB,SPC30,
     CV]"
AF   34 PRINTTAB(4)"[CB]  [CG,C+,
     CM,C£,S£,CN,SA,SB,CT,C@,CM,C
     £]  [SG,SH,SA,SB,CQ,CD,SQ,SR
     ,CG,C+,SPC4,CV]"
C4   35 PRINTTAB(4)"[UP,CY]$$$$$$
     $$$$$$$$$$$$$$$$$$$$$$$$[CU]
     "
D8   40 SYS52248,5,1,0,0,40,25
11   41 GOTO100
4E   45 A$="[CX40]"
EA   46 FORL=0TO23:PRINTA$;:NEXT:
     PRINT"[HOME]":FORL=1984TO202
     3:POKEL,125:NEXT
BC   50 RETURN
CA   100 PRINT"[WHITE,CLR]";
AA   101 PRINT"[CJ]##############
     ###########[CL]"
01   102 PRINT"[CB,SI,SJ,S+,C-,CM
     ,C£,SI,SJ,CT,C@] [CE,CR,SI,S
     J,SA,SB,CT,C@] ---- [CV]"
B5   103 PRINT"[CY]$$$$$$$$$$$$$$
     $$$$$$$$$$$[CU]"
FC   104 SYS52248,5,2,0,0,27,3
C8   110 PRINT"[WHITE,CLR]";
B1   111 PRINT"[CJ]##############
     ##########[CL]"
05   112 PRINT"[CB,C*,SSPC,CT,C@,
     SI,SJ,CG,C+,CG,C+] [SA,SB,S+
     ,C-,CE,CR] [SU,SV,SI,SJ,CE,C
     R,CV]"
F7   113 PRINT"[CY]$$$$$$$$$$$$$$
     $$$$$$$$$$[CU]"
5E   114 SYS52248,5,3,0,0,26,3
F9   115 PRINT"[WHITE,CLR]";
08   116 PRINT"[CC]'[SY,SZ,SA,SB,
     SQ,SR,S+,C-] [SY,SZ,SI,SJ,S+
     ,C-,S£,CN]@@@@@@@@'[CF]"
08   117 PRINT"[CJ]##############
     ############[CL]"
D2   118 PRINT"[CB,SPC3,SW,SX,S-,
     PI,SA,SB,SG,SH] [CG,C+,SO,SP
     ,SI,SJ,SI,SJ,CM,C£,SPC5,CV]"
D3   119 PRINT"[CB,SPC27,CV]"
BB   120 PRINT"[CB,SPC3,CG,C+,SA,
     SB,CQ,CD,SI,SJ] [CG,C+,SO,SP
     ,SI,SJ,SI,SJ,CM,C£,SPC5,CV]"
C5   121 PRINT"[CB,SPC27,CV]"
31   122 PRINT"[CB,SPC3,SI,SJ,S+,
     C-,CM,C£,SI,SJ,CT,C@] [SG,SH
     ,SA,SB,CM,C£,SA,SB,SPC5,CV]"
C7   123 PRINT"[CB,SPC27,CV]"
DF   124 PRINT"[CB,SPC3,CZ,CS,SQ,
     SR,C*,SSPC,SI,SJ] [CG,C+,SO,
     SP,SI,SJ,SI,SJ,CM,C£,SPC5,CV
     ]"
C9   125 PRINT"[CB,SPC27,CV]"
09   126 PRINT"[CB,SPC3,CQ,CD,SQ,
     SR,SI,SJ,CZ,CS] [CG,C+,SO,SP
     ,SI,SJ,SI,SJ,CM,C£,SPC5,CV]"
CB   127 PRINT"[CB,SPC27,CV]"
8E   128 PRINT"[CB] [C*,SSPC,CT,C
     @,SQ,SR,S+,C-,CM,C£] [CG,C+,
     SO,SP,SI,SJ,SI,SJ,CM,C£,SPC5
     ,CV]"
3D   129 PRINT"[CB,SPC27,CV]"
98   130 PRINT"[CB,CT,C@,SI,SJ]-[
     S+,C-,SA,SB,SY,SZ,SI,SJ] [CG
     ,C+,SO,SP,SI,SJ,SI,SJ,CM,C£,
     SPC3,CV]"
3F   131 PRINT"[CB,SPC27,CV]"
11   132 PRINT"[CB,CQ,CD,SQ,SR,SI
     ,SJ,CZ,CS] [SE,SF,S-,PI,S+,C
     -,CM,C£,SI,SJ,S+,C-,CM,C£,CG
     ,C+]  [CV]"
41   133 PRINT"[CB,SPC27,CV]"
92   134 PRINT"[CB,SPC9,SI,SJ,CP,
     CA,SQ,SR,CM,C£,SPC10,CV]"
9D   135 PRINT"[CY]$$$$$$$$$$$$$$
     $$$$$$$$$$$$$[CU]"
41   136 SYS52248,5,4,0,0,29,20
20   150 PRINT"[WHITE,CLR]";
AE   152 PRINT"[CJ]##############
     ##################[CL]"
73   153 PRINT"[CB] [BLACK,SA,SB,
     CT,C@,SI,SJ] [CE,CR,S-,PI,S£
     ,CN] [CG,C+,S£,CN,CT,C@,SI,S
     J] ? [CE,CR]/[S+,C-,WHITE] [
     CV]"
68   154 PRINT"[CY]$$$$$$$$$$$$$$
     $$$$$$$$$$$$$$$$$$[CU]"
BC   155 SYS52248,5,5,0,0,34,3
0E   160 PRINT"[WHITE,CLR]";
62   161 PRINT"[CC]'LOAD SHEET@@@
     @@@@@@@@@@'[CF]"
DF   162 PRINT"[CJ]##############
     ##########[CL]"
F9   163 PRINT"[CB,SI,SJ,S+,C-,CM
     ,C£,SI,SJ,CT,C@] [SY,SZ,S-,P
     I,S+,C-,CM,C£,SO,SP] ---[CV]
     "
D6   164 PRINT"[CY]$$$$$$$$$$$$$$
     $$$$$$$$$$$[CU]"
9E   165 SYS52248,5,6,0,0,27,4
FC   170 PRINT"[WHITE,CLR]";
CD   171 PRINT"[CC]'SAVE SHEET@@@
     @@@@@@@@@@'[CF]"
65   172 PRINT"[CJ]##############
     ###########[CL]"
EF   173 PRINT"[CB,SI,SJ,S+,C-,CM
     ,C£,SI,SJ,CT,C@] [SY,SZ,S-,P
     I,S+,C-,CM,C£,SO,SP] ---[CV]
     "
6C   174 PRINT"[CY]$$$$$$$$$$$$$$
     $$$$$$$$$$$[CU]"
9B   175 SYS52248,5,7,0,0,27,4
3A   180 PRINT"[WHITE,CLR]";
E8   181 PRINT"[CC]'RENAME SHEET@
     @@@@@@@'[CF]"
93   182 PRINT"[CJ]##############
     #########[CL]"
6A   183 PRINT"[CB] ENTER OLDNAME
     : ---[SPC4,CV]"
48   184 PRINT"[CB] ENTER NEWNAME
     : ---[SPC4,CV]"
2B   185 PRINT"[CY]$$$$$$$$$$$$$$
     $$$$$$$$$[CU]"
20   186 SYS52248,5,8,0,0,25,5
38   190 PRINT"[WHITE,CLR]";
AD   191 PRINT"[CC]'DISPLAY CONTE
     NTS'[CF]"
CA   192 PRINT"[CJ]##############
     ####[CL]"
C4   193 PRINT"[CB] YEAR:[SPC12,C
     V]"
A2   194 PRINT"[CB,SPC18,CV]"
A3   195 PRINT"[CB,SPC18,CV]"
5C   196 PRINT"[CB,SPC18,CV]"
5D   197 PRINT"[CB,SPC18,CV]"
1E   198 PRINT"[CB,SPC18,CV]"
1F   199 PRINT"[CB,SPC18,CV]"
A8   200 PRINT"[CB,SPC18,CV]"
A9   201 PRINT"[CB,SPC18,CV]"
AA   202 PRINT"[CB,SPC18,CV]"
AB   203 PRINT"[CB,SPC18,CV]"
A4   204 PRINT"[CB,SPC18,CV]"
A5   205 PRINT"[CB,SPC18,CV]"
A6   206 PRINT"[CB,SPC18,CV]"
ED   207 PRINT"[CY]$$$$$$$$$$$$$$
     $$$$[CU]"
B5   208 SYS52248,5,9,0,0,20,17
14   210 PRINT"[WHITE,CLR]";
6A   211 PRINT"[CC]'[SG,SH,SQ,SR,
     CG,C+,SU,SV] [SI,SJ,CT,C@,CT
     ,C@,S-,PI,CT,C@]!'[CF]"
9E   212 PRINT"[CJ]##############
     ########[CL]"
AD   213 PRINT"[CB,SPC22,CV]"
F4   214 PRINT"[CY]$$$$$$$$$$$$$$
     $$$$$$$$[CU]"
6A   215 SYS52248,5,10,0,0,24,4
12   220 PRINT"[WHITE,CLR]";
32   221 PRINT"[CC]'[C*,SSPC,CT,C
     @,SQ,SR,S+,C-,CM,C£] [SY,SZ,
     SI,SJ,S+,C-,S£,CN]@'[CF]"
B6   222 PRINT"[CB,SPC22,CV]"
39   223 PRINT"[CB] ABORT[SPC16,C
     V]"
80   224 PRINT"[CB,SPC22,CV]"
9C   225 PRINT"[CB] PRINT WHOLE S
     HEET[SPC4,CV]"
82   226 PRINT"[CB,SPC22,CV]"
74   227 PRINT"[CB] PRINT PART SH
     EET[SPC5,CV]"
BC   228 PRINT"[CB,SPC22,CV]"
BB   229 PRINT"[CB] CHANGE PRINT
     FORMAT  [CV]"
84   230 PRINT"[CY]$$$$$$$$$$$$$$
     $$$$$$$$[CU]"
E4   235 SYS52248,5,11,0,0,24,10
3E   240 PRINT"[WHITE,CLR]";
61   241 PRINT"[CC]'CHANGE PRINT
     FORMAT@'[CF]"
8C   242 PRINT"[CJ]##############
     ########[CL]"
AB   243 PRINT"[CB]  PRINT MENU[S
     PC10,CV]"
8C   244 PRINT"[CB,SPC22,CV]"
3B   245 PRINT"[CB]  PRINT SLASH
     ZERO[SPC4,CV]"
8E   246 PRINT"[CB,SPC22,CV]"
50   247 PRINT"[CB]  PRINT BOLDFA
     CE[SPC6,CV]"
98   248 PRINT"[CB,SPC22,CV]"
73   249 PRINT"[CB]  PRINT EMPHAS
     ISED[SPC4,CV]"
9A   250 PRINT"[CB,SPC22,CV]"
33   251 PRINT"[CB]  PRINT NLQ[SP
     C11,CV]"
94   252 PRINT"[CB,SPC22,CV]"
D1   253 PRINT"[CB]  PRINT ITALIC
     S[SPC7,CV]"
6C   254 PRINT"[CY]$$$$$$$$$$$$$$
     $$$$$$$$[CU]"
D9   255 SYS52248,5,12,0,0,24,14
A7   260 PRINT"[WHITE,CLR]";
```

```
37  261 PRINT"[CC]'PRINT PART SH
    EET'[CF]"
F3  262 PRINT"[CJ]###############
    ####[CL]"
7B  263 PRINT"[CB] FROM RECORD -
    -[SPC3,CV]"
C3  264 PRINT"[CB,SPC3]TO RECORD
    --[SPC3,CV]"
98  265 PRINT"[CY]$$$$$$$$$$$$$$
    $$$$[CU]"
3A  266 SYS52248,5,13,0,0,20,5
AD  270 PRINT"[WHITE,CLR]";
18  271 PRINT"[CC]'WIPE SHEET@@@
    @@@@@@@@@@'[CF]"
E6  272 PRINT"[CJ]###############
    ###########[CL]"
10  273 PRINT"[CB,SI,SJ,S+,C-,CM
    ,C£,SI,SJ,CT,C@] [SY,SZ,S-,P
    I,S+,C-,CM,C£,SO,SP] ---[CV]
    "
A9  274 PRINT"[CY]$$$$$$$$$$$$$$
    $$$$$$$$$$$[CU]"
4A  275 SYS52248,5,14,0,0,27,4
53  280 PRINT"[WHITE,CLR]";
08  281 PRINT"[CC]'[SI,SJ,S+,C-,
    CM,C£,SI,SJ,CT,C@] [SG,SH,SA
    ,SB,CM,C£,SA,SB]@@@@@@@@@@@@
    @@@@@'[CF]";
72  282 PRINT"[CJ]###############
    ##########################[CL]
    ";
F3  283 PRINT"[CB,SPC3]DATE: ---
    -----[SPC21,CV]";
30  284 PRINT"[CB,SPC38,CV]";
45  285 PRINT"[CB,SPC3]DETAILS[S
    PC28,CV]";
32  286 PRINT"[CB,SPC38,CV]";
F3  287 PRINT"[CB]--------------
    -------------------------[CV]
    ";
FC  288 PRINT"[CB,SPC38,CV]";
B0  289 PRINT"[CB,SPC3]PAID IN:-
    ---.--[SPC4,C8,CJ]##########
    ###[CL,WHITE] [CV]";
18  290 PRINT"[CB,SPC22,C8,CB,C7
    ]REMEMBER TO[C8]  [CV,WHITE]
    [CV]";
E5  291 PRINT"[CB] WITHDRAWN:---
    -.--[SPC4,C8,CB,C7]TYPE OVER
    [C8,SPC3,CV,WHITE] [CV]";
35  292 PRINT"[CB,SPC22,C8,CB,C7
    ]DECIMAL POINT[C8,CV,WHITE]
    [CV]";
C0  293 PRINT"[CB,SPC3]BALANCE:[
    SPC11,C8,CY]$$$$$$$$$$$$$[CU
    ,WHITE] [CV]";
40  294 PRINT"[CY]$$$$$$$$$$$$$$
    $$$$$$$$$$$$$$$$$$$$$$$$[CU]
    ";
B1  295 SYS52248,5,15,0,0,40,14
```

PROGRAM: LISTING 5

```
B0  10 BL=5:LN=50:SA=8192
5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
A5  30 READ A:IF A><CX THENPRINT
    "ERROR IN LINE";LN+(L*10):ST
    OP
40  40 NEXT L:END
F8  50 DATA 190,0,0,66,67,69,0,0
    ,0,0,169,11,141,17,208,169,1
    107
8F  60 DATA 1,168,162,8,32,186,2
    55,162,3,160,32,32,189,255,1
    69,0,1814
61  70 DATA 133,10,32,213,255,16
    2,4,160,32,169,1,32,189,255,
    169,0,1816
81  80 DATA 133,10,32,213,255,16
    2,5,160,32,169,1,32,189,255,
    169,0,1817
09  90 DATA 133,10,32,213,255,16
    9,0,133,45,169,61,133,46,32,
    92,166,1689
90  100 DATA 32,142,166,76,174,1
    67,0,0,0,0,0,0,0,0,0,0,757
```

PROGRAM: LISTING 6

```
B9  10 REM*********LISTING 6****
    ****
80  15 REM
11  20 REM*****MACHINE CODE BOOT
    ****
96  25 REM
21  50 FORA=732TO767:READX:POKEA
    ,X:NEXT
BD  100 DATA65,169,6,141,134,2,3
    2,68,229,169,1,168,162,8,32,
    186,255
D3  105 DATA162,220,160,2,169,1,
    32,189,255,169,0,133,10,32,2
    13,255
74  110 DATA76,10,32
```

PROGRAM: LISTING 7

```
B8  10 REM*******LISTING 7******
    **
80  15 REM
9F  20 REM*SAVER FOR BOOT PROGRA
    M*
96  25 REM
69  50 SYS57812"SHEET",8,1
E7  60 POKE193,220:POKE194,2
70  70 POKE174,4:POKE175,3
C4  80 POKE770,221:POKE771,2
6B  90 SYS62957
5E  100 POKE770,134:POKE771,164
```

Icon 64

PROGRAM: ICON64.BAS

```
E2  1 REM* YOU SHOULD ENTER THE
    FOLLOWING
64  2 REM* BEFORE LOADING THIS P
    ROG.
B6  3 REM*
11  4 REM* POKE43,0:POKE44,32:PO
    KE8191,0:NEW
B4  5 REM*
E6  10 BL=57:LN=50:SA=2049
5B  20 FOR L=0 TO BL:CX=0:FOR D=
    0 TO 15:READ A:CX=CX+A:POKE
    SA+L*16+D,A:NEXT D
77  30 PRINT".";:READ A:IF A><CX
     THENPRINT"ERROR IN LINE";LN
    +(L*10):STOP
86  40 NEXT L
D2  50 DATA 11,8,0,0,158,50,48,5
    4,49,0,0,0,169,12,133,44,736
1B  60 DATA 162,0,142,0,12,142,1
    ,12,142,2,12,189,88,9,157,11
    9,1189
BD  70 DATA 2,232,224,4,208,245,
    134,198,162,0,189,72,9,157,0
    ,208,2044
8C  80 DATA 232,224,16,208,245,1
    62,0,189,64,9,157,248,7,232,
    224,8,2225
64  90 DATA 208,245,32,90,8,234,
    96,120,169,121,141,20,3,169,
    8,141,1805
24  100 DATA 21,3,88,169,255,141
    ,21,208,96,162,0,169,14,157,
    39,208,1751
05  110 DATA 232,224,8,208,248,9
    6,120,169,49,141,20,3,169,23
    4,141,21,2083
68  120 DATA 3,88,169,0,141,21,2
    08,96,173,0,220,201,119,240,
    21,201,1901
1B  130 DATA 123,240,30,201,111,
    208,36,32,90,8,166,252,169,1
    ,157,39,1863
FC  140 DATA 208,76,193,8,238,0,
    208,173,0,208,201,242,240,3,
    76,172,2246
60  150 DATA 8,206,0,208,173,0,2
    08,201,26,240,233,173,0,208,
    201,26,2111
ED  160 DATA 176,3,76,106,9,201,
    51,144,3,76,199,8,169,1,133,
    252,1607
65  170 DATA 238,39,208,76,96,9,
    201,58,176,3,76,218,8,201,83
    ,144,1834
80  180 DATA 3,76,218,8,169,2,76
    ,191,8,201,90,176,3,76,237,8
    ,1542
1E  190 DATA 201,115,144,3,76,23
    7,8,169,3,76,191,8,201,122,1
    76,3,1733
50  200 DATA 76,0,9,201,147,144,
    3,76,0,9,169,4,76,191,8,201,
    1314
B1  210 DATA 154,176,3,76,19,9,2
    01,179,144,3,76,19,9,169,5,7
    6,1318
73  220 DATA 191,8,201,186,176,3
    ,76,38,9,201,211,144,3,76,38
    ,9,1570
DB  230 DATA 169,6,76,191,8,201,
    218,176,3,76,57,9,201,243,14
    4,3,1781
B6  240 DATA 76,57,9,169,7,76,19
    1,8,169,0,76,191,8,0,0,38,10
    75
66  250 DATA 39,40,41,42,43,44,4
    5,100,232,26,228,58,228,90,2
    28,122,1606
FF  260 DATA 228,154,228,186,228
    ,218,228,67,76,82,13,0,0,0,0
    ,173,1881
C6  270 DATA 0,220,201,111,208,1
    1,169,1,133,251,165,252,133,
    253,76,49,2233
75  280 DATA 234,169,0,133,251,7
    6,49,234,0,0,211,74,69,78,21
    1,128,1917
9A  290 DATA 0,0,224,0,0,120,0,0
    ,126,0,0,63,128,0,63,224,948
E5  300 DATA 0,31,240,0,31,0,0,1
    3,128,0,12,192,0,4,96,0,747
9E  310 DATA 4,48,0,0,24,0,0,8,0
    ,0,0,0,0,0,0,0,84
5E  320 DATA 0,0,0,0,0,0,0,0,0,0
    ,0,0,0,0,199,255,454
2D  330 DATA 255,255,128,0,1,191
    ,255,253,160,127,253,160,127
    ,249,160,127,2701
FE  340 DATA 249,160,127,253,191
    ,255,253,191,255,253,191,231
    ,253,191,195,253,3501
2C  350 DATA 191,195,253,191,231
    ,253,191,253,253,191,255,253
    ,191,231,253,191,3576
BA  360 DATA 231,253,191,231,253
    ,191,255,253,128,0,1,255,255
    ,255,0,255,3007
22  370 DATA 255,255,128,0,1,128
    ,0,1,128,0,1,128,0,1,128,0,1
    154
```

```
69  380 DATA 1,128,0,1,143,255,2
    41,159,255,249,159,255,249,1
    58,255,121,2629
02  390 DATA 156,66,57,158,195,1
    21,159,255,249,159,255,249,1
    57,219,185,143,2783
48  400 DATA 255,241,128,0,1,128
    ,0,1,128,0,1,255,255,255,0,2
    55,1903
23  410 DATA 255,255,128,0,1,128
    ,0,1,128,62,1,128,127,1,128,
    227,1570
02  420 DATA 129,128,193,129,128
    ,1,129,128,1,129,128,3,129,1
    28,7,1,1491
FD  430 DATA 128,14,1,128,28,1,1
    28,24,1,128,24,1,128,24,1,12
    8,887
B5  440 DATA 0,1,128,24,1,128,24
    ,1,128,0,1,255,255,255,0,255
    ,1456
1B  450 DATA 255,255,128,0,1,128
    ,0,1,128,192,1,128,176,1,128
    ,131,1653
AC  460 DATA 1,128,194,193,128,1
    78,1,128,131,1,128,130,193,1
    28,130,1,1793
E4  470 DATA 128,130,1,131,130,1
    ,135,130,1,131,14,1,128,30,1
    ,128,1220
80  480 DATA 12,1,128,0,1,128,0,
    1,128,0,1,255,255,255,199,25
    5,1619
CD  490 DATA 255,255,128,0,1,128
    ,0,1,128,0,1,128,127,249,128
    ,64,1593
49  500 DATA 21,128,128,61,128,1
    28,33,129,0,65,129,0,65,134,
    0,253,1402
4C  510 DATA 139,255,141,144,0,2
    1,191,255,229,160,0,41,160,0
    ,49,159,1944
6E  520 DATA 255,225,159,255,193
    ,128,0,1,128,0,1,255,255,255
    ,199,255,2564
7F  530 DATA 255,255,128,0,1,128
    ,0,1,159,255,249,144,0,9,144
    ,129,1857
9E  540 DATA 9,144,66,9,144,36,9
    ,151,129,233,144,36,9,144,66
    ,9,1338
B6  550 DATA 144,129,9,144,0,9,1
    59,255,249,144,0,9,149,42,16
    9,144,1755
F5  560 DATA 0,9,159,255,249,128
    ,0,1,128,0,1,255,255,255,199
    ,255,2149
63  570 DATA 255,255,128,0,1,128
    ,24,1,128,126,1,135,255,225,
    136,0,1798
D6  580 DATA 17,135,255,225,133,
    36,161,133,36,161,133,36,161
    ,133,36,161,1952
17  590 DATA 133,36,161,133,36,1
    61,133,36,161,133,36,161,133
    ,36,161,133,1783
84  600 DATA 36,161,133,36,161,1
    35,255,225,128,0,1,255,255,2
    55,199,173,2408
6C  610 DATA 0,220,201,111,208,7
    ,169,1,133,251,76,147,11,169
    ,0,76,1780
0E  620 DATA 137,11,165,251,201,
    1,208,4,165,252,133,253,76,4
    9,0,0,1906
D7  630 REM * GET READY TO SAVE
    ICON64 *
B1  640 PRINT"[CLR,DOWN2]PRESS A
    NY KEY TO SAVE ICON 64"
4B  650 PRINT"[DOWN]ONCE SAVED T
    HIS PROGRAM IS NO"
87  660 PRINT"LONGER REQUIRED. Y
    OU LOAD ICON64"
58  670 PRINT"AS A NORMAL BASIC
    PROGRAM AND RUN IT"
49  680 GETK$:IFK$=""THEN680
5F  690 POKE43,1:POKE44,8:POKE45
    ,161:POKE46,11:SAVE"ICON64",
    8,1
A8  700 REM ** CHANGE ,8 TO ,1 F
    OR TAPE *
```

PROGRAM: ICON64 DEMO

```
1B  100 POKE53281,0:REM SET SCRE
    EN COLOUR
2F  110 POKE53280,14:REM SET BOR
    DER COLOUR
28  120 POKE2141,14:REM ICON COL
    OUR
E7  130 SYS2138:REM SET ICON COL
    OURS
0D  140 POKE2190,1:REM SET HI-LI
    GHT COLOUR
F8  150 PRINT"[CLR,YELLOW]  [RVS
    ON]ICON 64 DEMO (C) M MEDHUR
    ST NOV 1988[RVSOFF]"
66  160 PRINT"[BLUE]  [CU36]"
16  170 PRINT"[DOWN,WHITE]USE A
    JOYSTICK IN PORT #2 TO CONTR
    OL"
57  180 PRINT"[WHITE,DOWN]THE PO
    INTER AND PRESS FIRE TO SELE
    CT AN [DOWN]ICON"
8D  190 SYS2089:REM INITALISE IC
    ON 64
E2  200 SYS2120:REM TURN ON ICON
    S
C8  210 PRINT"[HOME,WHITE,DOWN7,
    RIGHT5,YELLOW]";
99  220 FB=PEEK(251)
19  230 REM FB=FIRE BUTTON YES =
    1 NO =0
BD  240 FC=PEEK(252)
4A  250 REM FC=ICON UNDER POINTE
    R 1-7
7E  260 FD=PEEK(253)
82  270 REM FD=LAST ICON SELECTE
    D 1-7
C4  280 IFFB THEN ON FC GOSUB300
    ,310,320,330,340,350,360
1D  290 GOTO210
25  300 PRINT"DISK[SPC4]":RETURN
3C  310 PRINT"TAPE[SPC4]":RETURN
4A  320 PRINT"QUESTION":RETURN
2F  330 PRINT"MUSIC[SPC3]":RETUR
    N
6C  340 PRINT"PRINTER ":RETURN
D3  350 PRINT"CLEAR[SPC3]":RETUR
    N
81  360 PRINT"BIN[SPC5]":RETURN
```

80 Columns

PROGRAM: SD80.OBJ.BAS

```
10 DATA 1300
20 DATA 4C,79,19,00,00,00,00,00,
7F,02,AF,00,00,02,00,00,E0,38,4C
,39,03AD
30 DATA 1A,4C,54,1A,75,43,00,98,
24,68,04,00,00,3F,00,00,07,FF,01
,01,03FB
40 DATA 01,FF,00,00,30,30,00,3F,
3F,04,20,3C,14,90,03,4C,FE,13,AD
,0D,04FC
50 DATA 13,D0,03,4C,02,14,AD,05,
13,8D,22,13,AD,04,13,8D,21,13,AD
,22,0523
60 DATA 13,CD,09,13,90,12,F0,03,
4C,FE,13,AD,21,13,CD,08,13,90,05
,F0,073C
70 DATA 03,4C,FE,13,20,4F,16,AD,
06,13,F0,0A,CD,18,13,90,1C,F0,1A
,4C,069F
80 DATA EC,13,AD,23,13,D0,6D,AD,
18,13,D0,0D,A9,01,8D,23,13,CD,06
,13,0727
90 DATA B0,03,4C,EC,13,AD,22,13,
8D,1A,13,AD,21,13,8D,19,13,A9,00
,8D,066A
100 DATA 31,13,AD,9C,17,D0,3C,AD
,1A,13,CD,09,13,90,12,F0,03,4C,E
0,13,0747
110 DATA AD,19,13,CD,08,13,90,05
,F0,03,4C,E0,13,20,FB,14,20,12,1
9,20,0622
120 DATA 7B,16,20,12,19,AD,0C,13
,D0,2C,EE,19,13,D0,03,EE,1A,13,E
E,31,06CB
130 DATA 13,4C,A2,13,20,63,17,CE
,9C,17,CE,18,13,4C,6B,13,AD,21,1
3,18,05EB
140 DATA 6D,31,13,8D,21,13,90,03
,EE,22,13,4C,4E,13,20,D5,18,60,A
D,06,05F5
150 DATA 13,8D,18,13,AD,04,13,8D
,19,13,20,FB,14,20,12,19,20,7B,1
6,20,0493
160 DATA 12,19,AD,0C,13,D0,1A,EE
,19,13,AD,19,13,CD,08,13,90,E4,F
0,E2,0802
170 DATA EE,18,13,AD,18,13,CD,0A
,13,90,D1,F0,CF,4C,FE,13,A9,00,A
2,8C,092F
180 DATA CA,9D,D9,17,D0,FA,8D,9D
,17,8D,9C,17,8D,6B,19,A5,9D,8D,1
1,19,09AC
190 DATA A9,00,85,9D,8D,0C,13,A9
,78,85,B8,A9,00,85,B9,A9,00,85,B
7,A9,094A
200 DATA 04,85,BA,20,C0,FF,90,0B
,C9,01,D0,07,A9,02,8D,0C,13,38,6
0,A2,07EF
210 DATA 78,20,C9,FF,90,07,A9,01
,8D,0C,13,38,60,A9,1B,20,6C,19,A
9,6C,0763
220 DATA 20,6C,19,AD,07,13,20,6C
,19,A9,0D,20,6C,19,AD,0D,13,F0,5
6,A9,0628
230 DATA 08,20,6C,19,AD,0B,13,29
,10,D0,40,AD,0B,13,29,08,F0,07,A
2,03,0559
240 DATA A9,02,4C,C0,14,A2,01,8A
,8E,28,13,8D,27,13,AD,0B,13,29,0
1,F0,066D
250 DATA 11,AD,0B,13,29,02,F0,05
,A2,03,4C,E0,14,A2,02,4C,E0,14,A
2,01,0668
260 DATA 8E,26,13,CA,F0,13,AD,28
,13,9D,28,13,4C,E3,14,A9,03,8D,2
6,13,0709
270 DATA A9,02,8D,27,13,18,60,48
,98,48,8A,48,20,0C,15,20,C8,15,6
8,AA,0634
280 DATA 68,A8,68,60,AD,19,13,8D
,1B,13,AD,1A,13,8D,1C,13,AD,0D,1
3,F0,06BF
290 DATA 4F,4E,1C,13,6E,1B,13,4E
,1C,13,6E,1B,13,4E,1C,13,6E,1B,1
3,AD,0447
300 DATA 0D,13,C9,02,90,36,AD,18
,13,8D,1D,13,A9,00,8D,1E,13,4E,1
D,13,052B
310 DATA 4E,1D,13,4E,1D,13,AD,1D
,13,8D,C6,15,AD,1E,13,8D,C7,15,2
0,9F,0647
```

```
320 DATA 15,AD,C6,15,18,6D,1B,13
,8D,1D,13,AD,C7,15,6D,1C,13,8D,1
E,13,05F0
330 DATA AD,18,13,8D,C6,15,A9,00
,8D,C7,15,20,9F,15,AD,C6,15,18,6
D,1B,074E
340 DATA 13,8D,1B,13,AD,C7,15,6D
,1C,13,8D,1C,13,AD,0D,13,D0,0C,A
D,1B,0620
350 DATA 13,8D,1D,13,AD,1C,13,8D
,1E,13,60,AD,C6,15,0E,C6,15,2E,C
7,15,0645
360 DATA 0E,C6,15,2E,C7,15,18,6D
,C6,15,8D,C6,15,90,03,EE,C7,15,A
2,04,07BE
370 DATA 0E,C6,15,2E,C7,15,CA,D0
,F7,60,90,24,AD,0E,13,18,6D,1B,1
3,8D,07A6
380 DATA 4D,16,AD,0F,13,6D,1C,13
,8D,4E,16,20,38,16,8D,1F,13,AD,0
D,13,04B9
390 DATA F0,18,AD,19,13,29,07,AA
,BD,1A,16,2D,1F,13,8D,1F,13,F0,3
6,AD,0699
400 DATA 0D,13,C9,01,F0,24,AD,10
,13,18,6D,1D,13,8D,4D,16,AD,11,1
3,6D,05B1
410 DATA 1E,13,8D,4E,16,20,38,16
,29,0F,8D,20,13,60,80,40,20,10,0
8,04,03E4
420 DATA 02,01,A2,1A,20,DA,CD,29
,F0,8D,20,13,60,A2,1A,20,DA,CD,2
9,0F,077A
430 DATA 8D,20,13,60,A2,12,AD,4E
,16,20,CC,CD,AD,4D,16,E8,20,CC,C
D,A2,08F1
440 DATA 1F,20,DA,CD,60,98,24,AD
,0A,13,8D,18,13,A9,00,8D,23,13,8
D,67,06E4
450 DATA 18,8D,68,18,AD,9D,17,8D
,9E,17,8D,9B,17,AE,26,13,CA,30,0
6,20,070E
460 DATA 93,18,4C,6C,16,A9,0D,20
,6C,19,60,48,8A,48,98,48,AD,0D,1
3,D0,06CB
470 DATA 0F,AD,1F,13,20,26,19,20
,6C,19,EE,9C,17,4C,C5,16,AD,0B,1
3,29,05AE
480 DATA 10,F0,06,20,CB,16,4C,C2
,16,AD,1F,13,F0,10,AE,26,13,CA,B
D,28,07A0
490 DATA 13,9D,2B,13,CA,10,F7,4C
,C2,16,A9,00,AE,26,13,CA,9D,2B,1
3,CA,07E2
500 DATA 10,FA,20,2D,17,68,A8,68
,AA,68,60,AD,0B,13,29,20,F0,09,A
D,1F,0731
510 DATA 13,D0,04,A2,01,D0,03,AE
,20,13,A9,00,CA,30,06,18,69,03,4
C,E0,0697
520 DATA 16,A8,B9,FD,16,8D,2B,13
,B9,FE,16,8D,2C,13,B9,FF,16,8D,2
D,13,0889
530 DATA 60,03,03,03,01,02,02,03
,01,03,01,00,01,01,02,01,01,00,0
0,00,007C
540 DATA 01,01,01,02,00,03,00,02
,00,03,00,03,00,03,01,00,02,03,0
1,03,001D
550 DATA 01,02,00,00,01,00,00,00
,00,AC,9B,17,88,30,0F,AE,26,13,C
A,30,040A
560 DATA F7,1E,2B,13,20,9F,17,4C
,36,17,AE,26,13,CA,30,0C,BD,2E,1
3,1D,05CA
570 DATA 2B,13,9D,2E,13,4C,45,17
,AD,9B,17,18,6D,27,13,8D,9B,17,C
9,07,05F1
580 DATA B0,01,60,AD,9B,17,38,E9
,07,8D,9D,17,AD,67,18,18,6D,26,1
3,8D,0750
590 DATA 67,18,AD,68,18,69,00,8D
,68,18,A2,00,BD,2E,13,09,80,20,6
C,19,05F0
600 DATA 20,93,18,E8,EC,26,13,90
,EF,EE,9C,17,AD,9E,17,8D,9B,17,6
0,05,08FE
610 DATA 00,00,00,08,8C,65,18,20
,69,18,B9,D9,17,2D,66,18,D0,06,3
9,1F,0534
620 DATA 18,4C,B7,17,19,1F,18,99
,1F,18,28,10,0C,B9,D9,17,0D,66,1
8,99,0563
630 DATA D9,17,4C,D5,17,A9,FF,38
,ED,66,18,39,D9,17,99,D9,17,AC,6
5,18,094E
640 DATA 60,00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00,00,0
0,00,0060
650 DATA 00,00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00,00,0
0,00,0000
660 DATA 00,00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00,00,0
0,00,0000
670 DATA 00,00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00,00,0
0,00,0000
680 DATA 00,00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00,00,0
0,00,0000
690 DATA 00,00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00,00,0
0,00,0000
700 DATA 00,00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00,00,0
0,00,0000
710 DATA 00,00,04,3A,00,8A,18,6D
,67,18,8D,24,13,8D,92,18,AD,68,1
8,69,055D
720 DATA 00,4A,6E,24,13,4E,24,13
,4E,24,13,AD,92,18,29,07,20,C1,1
8,8D,0506
730 DATA 66,18,AC,24,13,60,3A,20
,69,18,A9,00,8D,C0,18,B9,D9,17,2
D,66,06E6
740 DATA 18,F0,05,A9,01,8D,C0,18
,B9,1F,18,2D,66,18,F0,09,AD,C0,1
8,18,074D
750 DATA 69,02,8D,C0,18,AD,C0,18
,9D,2E,13,60,00,8E,D4,18,AA,BD,C
C,18,0858
760 DATA AE,D4,18,60,01,02,04,08
,10,20,40,80,00,A9,1B,20,6C,19,A
9,6C,0577
770 DATA 20,6C,19,A9,00,20,6C,19
,AD,0D,13,D0,0D,AD,6B,19,F0,05,A
9,92,06FE
780 DATA 20,6C,19,4C,FB,18,A9,0F
,20,6C,19,A9,0D,20,6C,19,20,6C,1
9,20,0581
790 DATA CC,FF,A9,78,20,C3,FF,AD
,11,19,85,9D,60,78,48,8A,48,A5,9
1,C9,0AB8
800 DATA 7F,F0,02,D0,05,A9,FF,8D
,0C,13,68,AA,68,60,AD,1F,13,30,0
5,2C,07B4
810 DATA 20,13,50,15,AD,6B,19,D0
,08,A9,12,20,6C,19,EE,6B,19,AD,1
F,13,0652
820 DATA 29,7F,4C,55,19,AD,6B,19
,F0,08,A9,92,20,6C,19,CE,6B,19,A
D,1F,0789
830 DATA 13,C9,20,90,08,C9,40,90
,0D,C9,60,90,06,18,69,40,4C,6A,1
9,18,06A1
840 DATA 69,20,60,18,48,20,D2,FF
,90,05,A9,01,8D,0C,13,68,60,08,4
8,8A,06C7
850 DATA 48,98,48,AD,00,FF,48,A9
,06,8D,00,FF,A0,00,A2,19,20,DA,C
D,29,08A2
860 DATA C0,C9,80,90,06,C9,81,90
,01,C8,C8,8C,0D,13,A2,0C,20,DA,C
D,8D,0988
870 DATA 0F,13,E8,20,DA,CD,8D,0E
,13,AD,0D,13,90,0F,A2,14,20,DA,C
D,8D,07F5
880 DATA 11,13,E8,20,DA,CD,8D,10
,13,AD,03,13,F0,65,A9,00,8D,04,1
3,8D,0775
890 DATA 05,13,8D,06,13,AD,0D,13
,F0,3C,A2,01,20,DA,CD,8D,08,13,A
9,00,0672
900 DATA 8D,09,13,0E,08,13,2E,09
,13,0E,08,13,2E,09,13,0E,08,13,2
E,09,01EF
910 DATA 13,CE,08,13,AD,08,13,C9
,FF,D0,03,CE,09,13,A2,06,20,DA,C
D,0A,07C2
920 DATA 0A,0A,AA,CA,8E,0A,13,4C
,2B,1A,A2,01,20,DA,CD,AA,CA,8E,0
8,13,074B
930 DATA A9,00,8D,09,13,A2,06,20
,DA,CD,AA,CA,8E,0A,13,20,32,13,6
8,8D,073A
940 DATA 00,FF,68,A8,68,AA,68,28
,60,08,48,AD,3C,03,8D,6D,1A,AD,3
D,03,074E
950 DATA 8D,6E,1A,A9,65,8D,3C,03
,A9,1A,8D,3D,03,68,28,60,08,48,A
D,6D,06D9
960 DATA 1A,8D,3C,03,AD,6E,1A,8D
,3D,03,68,28,60,C9,00,D0,03,20,7
9,19,0626
970 DATA 4C,00,00,00,00,00,00,00
,00,00,00,00,00,00,00,00,00,00,0
0,00,004C
980 DATA END
63995 PRINT"[CLEAR]":COLOR0,1:CO
LOR4,1:CHAR1,10,12,"[YELLOW]WORK
ING....$",1:CHAR1,14,14,"PLEASE
 WAIT",1:RESTORE
63996 READA$:S=DEC(A$):E=S:DO:RE
ADB$:IFB$="END"THENEXIT
63997 SU=0:FORJ=0TO19:B=DEC(B$):
POKEE+J,B:SU=SU+B:CHAR1,22,12,HE
X$(E+J)+"=$"+B$,1
63998 READB$:NEXT:E=E+20:IFSU<>D
EC(B$)THENPRINT"[CLEAR][DOWN][DO
WN][DOWN][DOWN][DOWN][c 3]DATA E
RROR IN LINE"PEEK(65)+256*PEEK(6
6):END
63999 LOOP:INPUT"[CLEAR][DOWN][D
OWN][DOWN][DOWN][DOWN][DOWN]FILE
NAME OF TARGET FILE:";N$:BSAVE(N
$),B0,P(S)TOP(E):END
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PROGRAM: 80COL.OBJ.BAS
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```
10 DATA F200
20 DATA 4C,93,F2,4C,A5,F2,4C,CF,
F2,4C,DA,F2,4C,EF,F2,00,00,00,00
,4C,0A52
30 DATA 08,F4,4C,BF,F4,4C,D8,F4,
00,4C,F9,F4,4C,FC,F4,00,00,00,00
,00,0988
40 DATA 00,4C,E4,F6,4C,2B,FA,4C,
7B,FA,00,00,FE,05,FE,84,80,84,FD
,A9,0A87
50 DATA 00,8D,F3,FF,60,1F,24,1F,
18,1F,0C,2B,18,1F,24,1F,18,1F,0C
,2B,0497
60 DATA 18,82,1F,0C,1F,06,2B,06,
94,00,00,0C,13,0C,1F,06,2B,06,13
,0C,024F
70 DATA 94,00,00,0C,1F,0C,1F,0C,
1F,06,2B,06,94,00,00,0C,13,0C,1F
,06,0230
80 DATA 2B,06,13,0C,94,00,00,0C,
1F,0C,82,88,4C,40,FB,00,00,00,00
,00,03AC
90 DATA 00,4C,0C,FD,4C,00,00,20,
B7,F2,8E,00,D6,2C,00,D6,10,FB,AD
,01,0789
100 DATA D6,20,C5,F2,60,20,B7,F2
,8E,00,D6,2C,00,D6,10,FB,8D,01,D
6,20,09CB
```

```
110 DATA C5,F2,60,48,AD,00,FF,8D
,CE,F2,29,FE,8D,00,FF,68,60,48,A
D,CE,0B96
120 DATA F2,8D,00,FF,68,60,00,48
,20,E3,F2,A2,1F,68,20,A5,F2,60,2
0,E3,09C6
130 DATA F2,A2,1F,20,93,F2,60,8A
,A2,12,20,A5,F2,98,E8,20,A5,F2,6
0,C9,0B0D
140 DATA 04,90,03,4C,07,F4,8D,73
,F4,98,48,8A,48,AD,73,F4,F0,4D,C
9,01,099F
150 DATA F0,35,A2,19,20,93,F2,09
,40,20,A5,F2,AD,73,F4,C9,02,F0,0
6,20,097A
160 DATA 45,F4,4C,C3,F3,A9,38,8D
,74,F4,A2,14,20,A5,F2,A9,E0,8D,7
5,F4,0BFD
170 DATA A2,15,20,A5,F2,A9,16,A2
,06,20,A5,F2,4C,B2,F3,A2,19,20,9
3,F2,09DD
180 DATA 29,BF,20,A5,F2,A2,06,A9
,19,20,A5,F2,4C,B2,F3,A2,19,20,9
3,F2,0A11
190 DATA 29,7F,09,40,20,A5,F2,A9
,00,A2,0C,20,A5,F2,E8,20,A5,F2,A
9,08,0906
200 DATA A2,14,20,A5,F2,A9,00,E8
,20,A5,F2,A9,19,A2,06,20,A5,F2,A
D,73,09F6 -
210 DATA F4,C9,03,90,03,4C,03,F4
,20,78,F4,A9,00,8D,0F,F2,8D,10,F
2,8D,0975
220 DATA 11,F2,A9,08,8D,12,F2,A9
,20,20,08,F4,A9,08,8D,10,F2,8D,1
2,F2,08FB
230 DATA A9,00,8D,0F,F2,8D,11,F2
,20,08,F4,4C,03,F4,A9,00,8D,76,F
4,8D,0953
240 DATA 77,F4,A2,0C,20,A5,F2,E8
,20,A5,F2,A2,19,20,93,F2,09,80,2
0,A5,0A1D
250 DATA F2,AD,73,F4,C9,03,B0,18
,A9,00,8D,11,F2,A9,40,8D,12,F2,A
9,00,09F6
260 DATA 8D,0F,F2,8D,10,F2,20,08
,F4,4C,03,F4,A9,00,8D,11,F2,A9,5
0,8D,093B
270 DATA 12,F2,A9,40,8D,10,F2,A9
,00,8D,0F,F2,20,08,F4,68,AA,68,A
8,60,0951
280 DATA 8D,44,F4,AD,10,F2,A2,12
,20,A5,F2,AD,0F,F2,E8,20,A5,F2,A
2,1F,0AED
290 DATA AD,44,F4,20,A5,F2,CA,A9
,FF,20,A5,F2,CE,12,F2,D0,ED,AD,1
1,F2,0D04
300 DATA F0,11,AA,CA,8A,A8,A2,1F
,AD,44,F4,20,A5,F2,98,CA,20,A5,F
2,60,087D
310 DATA 00,A9,40,8D,76,F4,A2,0C
,20,A5,F2,A9,00,8D,77,F4,E8,20,A
5,F2,0A85
320 DATA A9,80,8D,74,F4,A2,14,20
,A5,F2,A9,00,8D,75,F4,E8,20,A5,F
2,A9,0B72
330 DATA 19,A2,06,20,A5,F2,60,00
,00,00,00,00,A9,00,A0,D0,85,DA,8
4,DB,07AF
340 DATA A2,12,A9,20,20,A5,F2,E8
,A9,00,20,A5,F2,A0,00,A9,DA,8D,A
A,02,09D8
350 DATA A2,01,20,A2,02,A2,1F,20
,A5,F2,C8,C0,08,90,EC,A2,1F,A9,0
0,20,0875
360 DATA A5,F2,88,D0,FA,18,A5,DA
,69,08,85,DA,90,D9,E6,DB,A5,DB,C
9,E0,0DA3
370 DATA 90,D1,60,8E,F7,F4,29,0F
,8D,F5,F4,A2,1A,20,93,F2,29,F0,0
D,F5,0B64
380 DATA F4,20,A5,F2,AE,F7,F4,60
,8E,F7,F4,29,0F,0A,0A,0A,0A,8D,F
5,F4,0AF3
390 DATA A2,1A,20,93,F2,29,0F,0D
,F5,F4,20,A5,F2,AE,F7,F4,60,00,0
0,00,093F
400 DATA 00,38,B0,01,18,48,A9,01
,B0,02,A9,00,8D,27,FA,68,20,62,F
5,B0,078B
410 DATA 0F,8E,DF,F6,20,7F,F5,20
,3C,F6,AD,DF,F6,20,1D,F5,60,29,0
7,AA,0A46
420 DATA AD,27,FA,D0,09,AD,E0,F6
,3D,5A,F5,4C,34,F5,AD,E0,F6,1D,5
2,F5,0C12
430 DATA 8D,E0,F6,AD,27,FA,F0,12
,AD,73,F4,C9,02,90,08,AD,1C,F2,2
9,0F,0AA0
440 DATA 0D,E3,F6,8D,E3,F6,20,A0
,F6,60,80,40,20,10,08,04,02,01,7
F,BF,089F
450 DATA DF,EF,F7,FB,FD,FE,C9,02
,90,04,E0,80,B0,0D,48,AD,73,F4,F
0,0C,0C8F
460 DATA C9,02,F0,04,68,C0,C8,60
,68,C0,B0,60,68,38,60,8D,DE,F6,8
E,DD,0B13
470 DATA F6,8C,DB,F6,A9,00,8D,DC
,F6,4E,DE,F6,6E,DD,F6,4E,DE,F6,6
E,DD,0E2B
480 DATA F6,4E,DE,F6,6E,DD,F6,AD
,DC,F6,8D,E2,F6,AD,DB,F6,8D,E1,F
6,4E,0F6D
490 DATA E2,F6,6E,E1,F6,4E,E2,F6
,6E,E1,F6,4E,E2,F6,6E,E1,F6,20,7
9,F6,0E82
500 DATA AD,DB,F6,48,AD,DC,F6,48
,AD,E1,F6,8D,DB,F6,AD,E2,F6,8D,D
C,F6,0F53
510 DATA 20,79,F6,AD,DB,F6,8D,E1
,F6,AD,DC,F6,8D,E2,F6,68,8D,DC,F
6,68,0E84
520 DATA 8D,DB,F6,AD,DB,F6,18,6D
,DD,F6,8D,DB,F6,90,03,EE,DC,F6,A
D,DB,0E6D
530 DATA F6,18,6D,77,F4,8D,DB,F6
,AD,DC,F6,6D,76,F4,8D,DC,F6,AD,2
7,FA,0DC7
540 DATA F0,29,AD,73,F4,C9,02,90
,22,AD,E1,F6,18,6D,DD,F6,8D,E1,F
6,90,0C7A
550 DATA 03,EE,E2,F6,AD,E1,F6,18
,6D,75,F4,8D,E1,F6,AD,E2,F6,6D,7
4,F4,0DF9
560 DATA 8D,E2,F6,60,A2,12,AD,DC
,F6,20,A5,F2,AD,DB,F6,E8,20,A5,F
2,A2,0D6E
570 DATA 1F,20,93,F2,8D,E0,F6,AD
,27,FA,F0,20,AD,73,F4,C9,02,90,1
9,A2,0B2F
580 DATA 12,AD,E2,F6,20,A5,F2,AD
,E1,F6,E8,20,A5,F2,A2,1F,20,93,F
2,29,0C00
590 DATA F0,8D,E3,F6,60,AD,DB,F6
,0E,DB,F6,2E,DC,F6,0E,DB,F6,2E,D
C,F6,0DF2
600 DATA 18,6D,DB,F6,8D,DB,F6,90
,03,EE,DC,F6,A2,04,0E,DB,F6,2E,D
C,F6,0C8C
610 DATA CA,D0,F7,60,A2,12,AD,DC
,F6,20,A5,F2,AD,DB,F6,E8,20,A5,F
2,A2,0D9A
620 DATA 1F,AD,E0,F6,20,A5,F2,AD
,27,FA,F0,1E,AD,73,F4,C9,02,90,1
7,A2,0B5D
630 DATA 12,AD,E2,F6,20,A5,F2,AD
,E1,F6,E8,20,A5,F2,A2,1F,AD,E3,F
6,20,0CD8
640 DATA A5,F2,60,00,00,00,00,00
,00,00,00,00,8D,27,FA,8A,48,98,4
8,08,055F
650 DATA AD,24,F2,AE,23,F2,AC,25
,F2,20,62,F5,90,03,4C,7B,F8,AD,2
7,F2,0AD8
660 DATA AE,26,F2,AC,28,F2,20,62
,F5,90,03,4C,7B,F8,A9,00,8D,1C,F
A,20,09C1
670 DATA 81,F8,90,11,AD,1C,FA,09
,02,8D,1C,FA,AD,25,F2,38,ED,28,F
2,B0,0A3E
680 DATA 07,AD,28,F2,38,ED,25,F2
,8D,2A,FA,EE,2A,FA,20,8C,F8,90,1
B,AD,0AC9
690 DATA 1C,FA,09,01,8D,1C,FA,AD
,23,F2,38,ED,26,F2,8D,28,FA,AD,2
4,F2,0A34
700 DATA ED,27,F2,4C,66,F7,AD,26
,F2,38,ED,23,F2,8D,28,FA,AD,27,F
2,ED,0C10
710 DATA 24,F2,8D,29,FA,EE,28,FA
,D0,03,EE,29,FA,A9,00,8D,1F,FA,8
D,20,0AB6
720 DATA FA,8D,21,FA,8D,22,FA,8D
,1D,FA,8D,1E,FA,20,DF,F8,AD,29,F
A,D0,0C2B
730 DATA 22,AD,28,FA,CD,2A,FA,B0
,1A,AD,2A,FA,8D,18,FA,A9,00,8D,1
9,FA,0A65
740 DATA 8D,1B,FA,AD,28,FA,8D,1A
,FA,20,DA,F9,4C,1E,F8,AD,28,FA,8
D,18,0ADB
750 DATA FA,AD,29,FA,8D,19,FA,AD
,2A,FA,8D,1A,FA,A9,00,8D,1B,FA,2
0,DA,0B21
760 DATA F9,AD,1C,FA,29,01,F0,03
,20,A1,F8,20,D2,F8,20,8C,F8,B0,4
0,20,0A30
770 DATA E8,F8,20,F6,F8,90,F3,20
,17,F9,AD,1E,FA,D0,08,AD,1D,FA,C
D,2A,0BF9
780 DATA FA,90,12,20,E8,F8,AD,1D
,FA,38,ED,2A,FA,8D,1D,FA,B0,03,C
E,1E,0AEC
790 DATA FA,20,DF,F8,AD,1C,FA,29
,02,D0,06,20,81,F9,4C,D6,F7,20,A
8,F9,0B29
800 DATA 4C,D6,F7,4C,7B,F8,AD,1C
,FA,29,02,F0,03,20,A1,F8,20,D2,F
8,20,0A7C
810 DATA 81,F8,B0,4B,20,EF,F8,20
,F6,F8,90,F3,20,17,F9,AD,1E,FA,C
D,29,0BF7
820 DATA FA,90,22,F0,02,B0,08,AD
,1D,FA,CD,28,FA,90,16,20,EF,F8,A
D,1D,0A80
830 DATA FA,38,ED,28,FA,8D,1D,FA
,AD,1E,FA,ED,29,FA,8D,1E,FA,20,D
F,F8,0C56
840 DATA AD,1C,FA,29,01,D0,06,20
,2B,F9,4C,2B,F8,20,4F,F9,4C,2B,F
8,28,0875
850 DATA 68,A8,68,AA,60,AD,25,F2
,CD,28,F2,F0,01,60,18,60,AD,24,F
2,CD,0A86
860 DATA 27,F2,90,0C,F0,02,B0,08
,AD,23,F2,CD,26,F2,F0,EA,60,AD,2
3,F2,0B02
870 DATA 48,AD,24,F2,48,AD,26,F2
,8D,23,F2,AD,27,F2,8D,24,F2,68,8
D,27,0A3F
880 DATA F2,68,8D,26,F2,AD,25,F2
,AE,28,F2,8E,25,F2,8D,28,F2,AD,1
C,FA,0B9A
890 DATA 49,FF,8D,1C,FA,60,AD,24
,F2,AE,23,F2,AC,25,F2,20,7F,F5,6
0,A9,0B31
900 DATA 00,8D,25,FA,8D,26,FA,60
,20,D1,F9,20,2B,F9,60,20,D1,F9,2
0,81,09D2
910 DATA F9,60,EE,25,FA,D0,03,EE
,26,FA,AD,26,FA,CD,20,FA,90,0E,F
0,02,088B
920 DATA B0,0A,AD,25,FA,CD,1F,FA
,90,02,F0,01,60,38,60,AD,1D,FA,1
8,6D,0930
930 DATA 21,FA,8D,1D,FA,AD,1E,FA
,6D,22,FA,8D,1E,FA,60,EE,23,F2,D
0,03,0AE8
```

```
940 DATA EE,24,F2,AD,23,F2,29,07
,08,D0,08,EE,DB,F6,D0,03,EE,DC,F
6,28,0B50
950 DATA D0,08,EE,E1,F6,D0,03,EE
,E2,F6,60,CE,23,F2,AD,23,F2,C9,F
F,D0,0DD3
960 DATA 03,CE,24,F2,29,07,C9,07
,08,D0,0D,CE,DB,F6,AD,DB,F6,C9,F
F,D0,0B81
970 DATA 03,CE,DC,F6,28,D0,0D,CE
,E1,F6,AD,E1,F6,C9,FF,D0,03,CE,E
2,F6,0E12
980 DATA 60,EE,25,F2,AD,DB,F6,18
,69,50,8D,DB,F6,90,03,EE,DC,F6,A
D,25,0C37
990 DATA F2,29,07,D0,0E,AD,E1,F6
,18,69,50,8D,E1,F6,90,03,EE,E2,F
6,60,0B72
1000 DATA CE,25,F2,AD,DB,F6,38,E
9,50,8D,DB,F6,B0,03,CE,DC,F6,AD,
25,F2,0D49
1010 DATA 29,07,C9,07,D0,0E,AD,E
1,F6,38,E9,50,8D,E1,F6,B0,03,CE,
E2,F6,0B90
1020 DATA 60,20,3C,F6,AD,23,F2,4
C,1D,F5,AD,19,FA,CD,1B,FA,90,29,
F0,02,0A1F
1030 DATA B0,08,AD,18,FA,CD,1A,F
A,90,1D,AD,18,FA,38,ED,1A,FA,8D,
18,FA,0A9C
1040 DATA AD,19,FA,ED,1B,FA,8D,1
9,FA,EE,1F,FA,D0,D4,EE,20,FA,D0,
CF,AD,0D61
1050 DATA 18,FA,8D,21,FA,AD,19,F
A,8D,22,FA,60,00,00,00,00,00,00,
00,00,0683
1060 DATA 00,00,00,00,00,00,00,0
0,00,00,00,48,8E,F7,F4,A2,0C,20,
93,F2,0514
1070 DATA 49,10,20,A5,F2,8D,7A,F
A,A2,14,20,93,F2,49,10,20,A5,F2,
8D,10,0919
1080 DATA F2,68,F0,2A,A9,07,8D,1
2,F2,A9,FF,8D,11,F2,A9,00,8D,0F,
F2,20,0A44
1090 DATA 08,F4,AD,7A,FA,8D,10,F
2,A9,00,8D,0F,F2,8D,11,F2,A9,08,
8D,12,09C3
1100 DATA F2,A9,20,20,08,F4,AE,F
7,F4,60,00,48,A9,2E,85,DA,A9,0A,
85,DB,0A61
1110 DATA A9,DA,8D,AA,02,8D,B9,0
2,8C,F8,F4,8E,F7,F4,A0,00,A2,00,
20,A2,0AF9
1120 DATA 02,49,10,A2,00,20,AF,0
2,E6,DA,A2,00,20,A2,02,49,10,A2,
00,20,060F
1130 DATA AF,02,68,48,AE,F7,F4,A
C,F8,F4,20,2B,FA,68,D0,04,20,C4,
FA,60,0B51
1140 DATA 20,DE,FA,60,8E,F7,F4,A
2,19,78,BD,26,FB,48,B5,E0,9D,26,
FB,68,0BE5
1150 DATA 95,E0,CA,10,F1,58,AE,F
7,F4,60,8E,F7,F4,8C,F8,F4,A2,19,
BD,0C,0D06
1160 DATA FB,9D,26,FB,CA,10,F7,A
2,00,A0,00,20,A2,02,8D,29,FB,A2,
00,C6,09A9
1170 DATA DA,20,A2,02,8D,27,FB,A
E,F7,F4,AC,F8,F4,4C,C4,FA,00,00,
00,08,0A90
1180 DATA 18,00,00,4F,00,00,00,0
0,00,18,4F,00,00,07,07,00,00,00,
00,00,00DC
1190 DATA 00,00,00,00,00,00,00,0
0,00,00,00,00,00,00,00,00,00,00,
00,00,0000
1200 DATA 00,00,00,00,00,00,00,0
0,20,62,F5,90,03,4C,37,FC,8D,F6,
F4,AD,06AD
1210 DATA 73,F4,D0,03,4C,37,FC,A
D,33,F2,D0,03,4C,37,FC,C9,51,90,
03,4C,09D6
1220 DATA 37,FC,AD,32,F2,30,04,A
9,D0,30,02,A9,D8,8D,39,FC,A9,00,
8D,38,0994
1230 DATA FC,A9,01,8D,27,FA,AD,F
6,F4,8E,DF,F6,8C,03,FD,20,7F,F5,
AD,DB,0CF6
1240 DATA F6,8D,3A,FC,AD,DC,F6,8
D,3B,FC,AD,E1,F6,8D,3D,FC,AD,E2,
F6,8D,0E58
1250 DATA 3E,FC,AD,DF,F6,29,07,8
D,DF,F6,A2,00,8A,18,6D,3A,FC,8D,
DB,F6,0B93
1260 DATA AD,3B,FC,69,00,8D,DC,F
6,8A,18,6D,3D,FC,8D,E1,F6,AD,3E,
FC,69,0BA8
1270 DATA 00,8D,E2,F6,8D,34,F2,2
0,3F,FC,85,DA,A9,00,85,DB,06,DA,
26,DB,0AEC
1280 DATA 06,DA,26,DB,06,DA,26,D
B,A5,DA,18,6D,38,FC,85,DA,A5,DB,
6D,39,0A7F
1290 DATA FC,85,DB,8E,3C,FC,A0,0
0,A9,DA,8D,AA,02,A2,01,20,A2,02,
AE,3C,09CF
1300 DATA FC,20,6F,FC,AD,DB,F6,1
8,69,50,8D,DB,F6,90,03,EE,DC,F6,
C8,98,0CE7
1310 DATA 18,6D,03,FD,29,07,D0,0
E,AD,E1,F6,18,69,50,8D,E1,F6,90,
03,EE,09CD
1320 DATA E2,F6,C0,08,90,C6,E8,E
C,33,F2,B0,03,4C,A8,FB,60,00,00,
00,00,09F1
1330 DATA 00,00,00,C9,40,90,16,C
9,C0,B0,1B,C9,60,90,08,C9,80,90,
07,C9,086D
1340 DATA A0,90,06,38,E9,20,38,E
9,20,2C,32,F2,50,03,18,69,80,60,
C9,FF,0884
1350 DATA D0,04,A9,5E,10,EF,38,E
9,80,10,EA,8C,F8,F4,8E,F7,F4,8D,
00,FD,0BF0
1360 DATA AE,DF,F6,F0,70,8D,04,F
D,AA,CA,8E,02,FD,AD,00,FD,2D,02,
FD,8D,0C05
1370 DATA 01,FD,A9,08,38,ED,DF,F
6,AA,0E,01,FD,CA,D0,FA,AD,DC,F6,
48,AD,0C67
1380 DATA DB,F6,48,EE,DB,F6,D0,0
3,EE,DC,F6,AD,E2,F6,48,AD,E1,F6,
48,EE,0EF2
1390 DATA E1,F6,D0,03,EE,E2,F6,2
0,3C,F6,AD,E0,F6,0D,01,FD,20,34,
F5,68,0C01
1400 DATA 8D,E1,F6,68,8D,E2,F6,6
8,8D,DB,F6,68,8D,DC,F6,A9,FF,4D,
02,FD,0DB2
1410 DATA 2D,00,FD,8D,00,FD,AE,D
F,F6,F0,06,4E,00,FD,CA,D0,FA,20,
3C,F6,0B5E
1420 DATA AD,E0,F6,0D,00,FD,20,3
4,F5,AE,F7,F4,AC,F8,F4,60,00,00,
00,00,0A67
1430 DATA 01,02,04,08,10,20,40,8
0,8D,27,FA,8E,0A,FE,AD,88,F2,AE,
87,F2,0891
1440 DATA AC,89,F2,20,62,F5,90,0
3,4C,09,FE,AD,8B,F2,AE,8A,F2,AC,
8C,F2,0C02
1450 DATA 20,62,F5,90,03,4C,09,F
E,AD,0A,FE,F0,03,4C,C9,FD,AD,87,
F2,AE,0AEB
1460 DATA 88,F2,8D,23,F2,8D,26,F
2,8E,24,F2,8E,27,F2,AD,89,F2,8D,
25,F2,0BD8
1470 DATA AD,8C,F2,8D,28,F2,20,E
7,F6,AD,8A,F2,AE,8B,F2,8D,23,F2,
8D,26,0C78
1480 DATA F2,8E,24,F2,8E,27,F2,A
D,89,F2,8D,25,F2,AD,8C,F2,8D,28,
F2,20,0BFB
1490 DATA E7,F6,AD,89,F2,8D,25,F
2,8D,28,F2,AD,87,F2,AE,88,F2,8D,
23,F2,0D40
1500 DATA 8E,24,F2,AD,8A,F2,AE,8
B,F2,8D,26,F2,8E,27,F2,20,E7,F6,
AD,8C,0C7A
1510 DATA F2,8D,25,F2,8D,28,F2,A
D,87,F2,AE,88,F2,8D,23,F2,8E,24,
F2,AD,0C7E
1520 DATA 8A,F2,AE,8B,F2,8D,26,F
2,8E,27,F2,20,E7,F6,4C,09,FE,AD,
8C,F2,0C6E
1530 DATA CD,89,F2,B0,09,AE,89,F
2,8D,89,F2,8E,8C,F2,AD,87,F2,AE,
88,F2,0D8C
1540 DATA 8D,23,F2,8E,24,F2,AD,8
A,F2,AE,8B,F2,8D,26,F2,8E,27,F2,
AD,8C,0C1F
1550 DATA F2,8D,25,F2,8D,28,F2,2
0,E7,F6,CE,8C,F2,AD,8C,F2,CD,89,
F2,B0,0DA9
1560 DATA D1,60,00,00,00,00,00,0
0,00,00,00,00,00,00,00,00,00,00,
00,00,0131
1570 DATA END
63995 PRINT"[CLEAR]":COLOR0,1:CO
LOR4,1:CHAR1,10,12,"[YELLOW]WORK
ING....$",1:CHAR1,14,14,"PLEASE
 WAIT",1:RESTORE
63996 READA$:S=DEC(A$):E=S:DO:RE
ADB$:IFB$="END"THENEXIT
63997 SU=0:FORJ=0TO19:B=DEC(B$):
POKEE+J,B:SU=SU+B:CHAR1,22,12,HE
X$(E+J)+"=$"+B$,1
63998 READB$:NEXT:E=E+20:IFSU<>D
EC(B$)THENPRINT"[CLEAR][DOWN][DO
WN][DOWN][DOWN][DOWN][c 3]DATA E
RROR IN LINE"PEEK(65)+256*PEEK(6
6):END
63999 LOOP:INPUT"[CLEAR][DOWN][D
OWN][DOWN][DOWN][DOWN][DOWN]FILE
NAME OF TARGET FILE:";N$:BSAVE(N
$),B0,P(S)TOP(E):END
```

PROGRAM: 128/80/DEMO.BAS

```
10 REM
20 REM DEMONSTRATION PROGRAM FOR
 80 COLUMN PACKAGE
30 REM COPYWRITE D.KELSEY SEPTEM
BER 1988
40 REM
50 REM MAINLINE ROUTINE
60 REM
70 FAST
80 TRAP 1400
90 BANK 0:IF PEEK(DEC("1300"))<>
76 THEN BLOAD "SD80.OBJ"
100 POKE DEC("1303"),1:POKE DEC(
"1307"),0:POKE DEC("130B"),0:SYS
 DEC("1312")
110 BANK 1:IF PEEK(DEC("F200"))<
>76 THEN BLOAD "80COL.OBJ"
120 GOSUB 230:    REM DO TEXT DE
MONSTRATION
130 GOSUB 730:    REM DO HI-RES
MONO DEMO
140 GOSUB 1120:  REM DO HI-RES C
OLOUR DEMO
150 COLOR 6,1
160 END
170 REM
180 REM $"TEXT DEMO"
190 REM THIS DEMONSTRATION SHOWS
 THE FOLLOWING FACILITIES:
200 REM    POKE IN 80 COLUMNS
210 REM    SCREEN SWOP
220 REM
230 PRINT "□";CHR$(14);"¬RESS •P
ACE TO CHANGE CHARACTER, CURSOR
KEYS TO MOVE, RETURN TO END"
240 PRINT "[illegible]
[illegible]
[illegible] @'"
250 CH=0:X=40:Y=12
260 DO
```

```
270 : AD=X+Y*80 : REM SCREEN STA
RTS AT $0000
280 : SYS DEC("F206"),CH,INT(AD/
256),AD-INT(AD/256)*256
290 : DO
300 :    GETKEY A$
310 : LOOP UNTIL A$="□" OR A$="▣
" OR A$="▐" OR A$="▌" OR A$=" "
OR A$=CHR$(13) OR A$="P"
320 : IF A$="□" AND Y>1 THEN Y=Y
-1
330 : IF A$="▣" AND Y<25 THEN Y=
Y+1
340 : IF A$="▌" AND X<80 THEN X=
X+1
350 : IF A$="▐" AND X>0 THEN X=X
-1
360 : IF A$=" " THEN CH=CH+1: IF
 CH=255 THEN CH=0
370 LOOP UNTIL A$=CHR$(13)
380 REM
390 REM DO SWOP DEMO
400 REM
410 PRINT "□":COLOR 5,8
420 PRINT "THIS IS SCREEN 1. PRE
SS 'S' TO SWOP TO SCREEN 2"
430 PRINT
440 PRINT "THIS JUST SHOWS THAT
ALL TEXT IS KEPT ";
450 DO:GETKEY A$:LOOP UNTIL A$="
S"
460 SYS DEC("F22F"),1 : REM SWOP
 AND CLEAR
470 PRINT "THIS IS SCREEN 2. PRE
SS 'S' TO SWOP TO SCREEN 1, NOTE
 IN UPPER CASE"
480 PRINT
490 PRINT "THIS IS BECAUSE THIS
IS A NEW SCREEN."
500 DO:GETKEY A$:LOOP UNTIL A$="
S"
510 SYS DEC("F22F"),0 : REM SWOP
 ONLY
520 PRINT "AND DATA WILL STILL B
E DISPLAYED AT THE LAST POSITION
 OF THAT SCREEN"
530 PRINT "PRESS 'S' TO SWOP ONE
 MORE TIME"
540 DO:GETKEY A$:LOOP UNTIL A$="
S"
550 SYS DEC("F22F"),0
560 COLOR 5,14
570 PRINT CHR$(14);"NOW I HAVE C
HANGED COLOUR HERE AS WELL"
580 PRINT
590 PRINT "PRESS ANY KEY TO CONT
INUE"
600 GETKEY A$
610 SYS DEC("F22F"),0 : REM SWOP
 TO FIRST ORIGINAL SCREEN
620 RETURN
630 REM
640 REM $"MONO DEMO"
650 REM THIS SECTION DEMONSTRATE
S THE FOLLOWING ROUTINES
660 REM      MODE SELECT
670 REM      BACKGROUND COLOUR
680 REM      FOREGROUND COLOUR
690 REM      SET POINT
700 REM      DRAW LINE
710 REM      DISPLAY TEXT
720 REM
730 SYS DEC("F20C"),1 : REM TURN
 ON GRAPHICS
740 SYS DEC("F216"),5 : REM BACK
GROUND COLOUR
750 SYS DEC("F219"),1 : REM FORE
GROUND COLOUR
760 X1=0:Y1=0
770 X2=0:Y2=199:SC=1
780 GOSUB 1600: REM DRAW Y AXIS
790 X1=0:Y1=100
800 X2=639:Y2=100:SC=1
810 GOSUB 1600: REM DRAW X AXIS
820 FOR X=1 TO 639
830 : Y=90*SIN(X*π/180/2)+95:SC=
1
840 : GOSUB 1750: REM PLOT THE C
URVE
850 NEXT X
860 TE$=" THIS IS A SINE CURVE "
870 X=200:Y=192
880 MO=128:REM LOWER CASE
890 GOSUB 1890: REM DISPLAY TEXT
 ON SCREEN
900 FOR LO=1 TO 10
910 : FOR K=0 TO 15
920 :    SYS DEC("F219"),K  : REM
 RAPIDLY CHANGE FOREGROUND
930 : NEXT K
940 NEXT LO
950 SYS DEC("F219"),1
960 TE$="
"
970 X=200:Y=0
980 MO=0: REM LOWER CASE REVERSE
D
990 GOSUB 1890: REM CLEAR AREA
1000 TE$="PRESS A KEY TO CONTINU
E"
1010 GOSUB 1890
1020 GETKEY A$
1030 RETURN
1040 REM
1050 REM $"COLOUR DEMO"
1060 REM THIS DEMONSTRATES THE F
OLLOWING ROUTINES
1070 REM      DRAW LINE
1080 REM      DISPLAY TEXT
1090 REM      DRAW BOX
1100 REM      BACKGROUND COLOUR
1110 REM
1120 SYS DEC("F20C"),2 : REM TUR
N ON COLOUR GRAPHICS
1130 SYS DEC("F216"),11: REM SET
 BORDER COLOUR
1140 X1=5:Y1=0
1150 X2=5:Y2=150:SC=1:CO=8
1160 GOSUB 1600
1170 CC=8
1180 RESTORE 1350
1190 FOR M=1 TO 12
1200 : READ Y1
1210 : X1=(M-1)*53+14
1220 : Y2=150
1230 : X2=X1+40
1240 : SC=1:FF=1
1250 : IF CC=4 THEN CC=15:ELSE I
F CC=15 THEN CC=8:ELSE IF CC=8 T
HEN CC=4
1260 : CO=CC:GOSUB 2070: REM DRA
W A BOX AND FILL IT IN
1270 : TE$=STR$(M)
1280 : X=X1+10:Y=164:CO=3:GOSUB
1890
1290 NEXT M
1300 TE$="PRESS A KEY":CO=15:X=2
00:Y=0:MO=0:GOSUB 1890
1310 GETKEY A$
1320 SYS DEC("F20C"),0 : REM RET
URN TO TEXT
1330 RETURN
1340 REM $"DATA"
1350 DATA 50,132,95,113,60,79,80
,84,40,30,10,144
1360 REM
1370 REM $"ERROR"
1380 REM THIS ROUTINE TRAPS ANY
ERRORS
1390 REM
1400 SYS DEC("F20C"),0 : REM RET
URN TO TEXT TO SEE ERROR MESSAGE
1410 PRINT ERR$(ER);" IN LINE ";
EL
1420 COLOR 6,1
1430 END
1440 REM 80 COLUMN MODULE ROUTIN
ES
1450 REM
1460 REM TOTAL VARIABLES USED :
1470 REM
X1,Y1,X2,Y2,SC,CO,FF,YN,X,Y,TE$,
MO
1480 REM
1490 REM THESE SETS OF ROUTINES
PROVIDE SUBROUTINE MODULES FOR E
ASY ACCESS
1500 REM TO THE 80 COLUMN ROUTIN
ES
1510 REM
1520 REM $"DRAW LINE"
1530 REM THIS ROUTINE DRAWS A LI
NE
1540 REM INPUT VARIABLES :
1550 REM                    X1,Y1
- STARTING POINT OF LINE
1560 REM                    X2,Y2
- ENDING POINT ON LINE
1570 REM                    SC
= 1=SET POINT, 0=CLEAR POINT
1580 REM                    CO
- COLOUR ( IF IN CORRECT MODE )
1590 REM
1600 POKE DEC("F224"),INT(X1/256
):POKE DEC("F223"),X1-INT(X1/256
)*256
1610 POKE DEC("F225"),Y1
1620 POKE DEC("F227"),INT(X2/256
):POKE DEC("F226"),X2-INT(X2/256
)*256
1630 POKE DEC("F228"),Y2
1640 IF CO<256 AND CO>=0 THEN PO
KE DEC("F21C"),CO
1650 SYS DEC("F229"),SC
1660 RETURN
1670 REM
1680 REM $"PLOT POINT"
1690 REM THIS ROUTINE PLOTS OR C
LEARS A POINT
1700 REM INPUT VARIABLES :
1710 REM                    X,Y -
CO-ORDINATES OF POINT
1720 REM                    SC
= 1=SET POINT, 0=CLEAR POINT
1730 REM                    CO
- COLOUR ( IF IN CORRECT MODE )
1740 REM
1750 IF CO<=255 AND CO>=0 THEN P
OKE DEC("F21C"),CO
1760 IF SC=1 THEN SYS DEC("F21D"
),INT(X/256),X-INT(X/256)*256,Y
: ELSE BEGIN
1770 : SYS DEC("F220"),INT(X/256
),X-INT(X/256)*256,Y
1780 BEND
1790 RETURN
1800 REM
1810 REM $"DISPLAY TEXT"
1820 REM THIS ROUTINE DISPLAYS T
EXT ON THE SCREEN
1830 REM INPUT VARIABLES :
1840 REM                    X,Y -
CO-ORDINATES OF TOP LEFT START O
F TEXT
1850 REM                    TE$ -
TEXT TO BE DISPLAYED
1860 REM                    CO  -
COLOUR ( IF IN CORRECT MODE )
1870 REM                    MO  -
MODE OF TEXT
1880 REM
1890 FOR YN=1 TO LEN(TE$)
1900 : POKE DEC("F233")+YN,ASC(M
ID$(TE$,YN,1))
1910 NEXT YN
1920 POKE DEC("F233"),LEN(TE$)
1930 POKE DEC("F232"),MO
1940 IF CO<=255 AND CO>=0 THEN P
OKE DEC("F21C"),CO
```

```
1950 SYS DEC("F284"),INT(X/256),
X-INT(X/256)*256,Y
1960 RETURN
1970 REM
1980 REM $"DRAW BOX"
1990 REM THIS ROUTINE DRAWS A BO
X
2000 REM INPUT VARIABLES :
2010 REM                    X1,Y1
= TOP LEFT CORNER OF BOX
2020 REM                    X2,Y2
= BOTTOM RIGHT CORNER OF BOX
2030 REM                    SC
= 1=DRAW BOXT, 0=CLEAR BOX
2040 REM                    CO
= COLOUR ( IF IN CORRECT MODE )
2050 REM                    FF
= FILL BOX, 1=FILL, 0=NO FILL
2060 REM
2070 POKE DEC("F288"),INT(X1/256
):POKE DEC("F287"),X1-INT(X1/256
)*256
2080 POKE DEC("F289"),Y1
2090 POKE DEC("F28B"),INT(X2/256
):POKE DEC("F28A"),X2-INT(X2/256
)*256
2100 POKE DEC("F28C"),Y2
2110 IF CO<256 AND CO>=0 THEN PO
KE DEC("F21C"),CO
2120 SYS DEC("F28D"),SC,FF
2130 RETURN
```

Zeus

PROGRAM: ZEUS +4 LOADER

```
10 REM ************************
****
20 REM *
    *
30 REM * ZEUS BASIC LOADER PROGR
AM *
40 REM *
    *
50 REM * (C) COPYRIGHT 1988 M.R.
E  *
60 REM *
    *
70 REM ************************
****
80 REM
90 PRINTCHR$(27)"[RVSON]ZEUS BAS
IC LOADER PROGRAM"
100 PRINT"[DOWN]WRITTEN DECEMBER
 1988 BY M.EVERINGHAM"
110 PRINT"[DOWN][c T][c T][c T][
c T][c T][c T][c T][c T][c
T][c T][c T][c T][c T][c T][c T]
[c T][c T][c T][c T][c T][c
 T][c T][c T][c T][c T][c T][c T
][c T][c T][c T][c T][c T][
c T][c T][c T]"
120 IF PEEK(44)<>23 THEN PRINT"S
AVE PROGRAM, ENTER POKES AND REL
OAD":END
130 RESTORE:AD%=4097
140 FOR LI=1000 TO 2950 STEP 10
150 PRINT"[HOME][DOWN][DOWN][DOW
N][DOWN][DOWN]STORING LINE"LI:CH
%=0
160 FOR BY=0 TO 7
170 READ DA%
180 IF DA%<0 OR DA%>255 THEN PRI
NT"[DOWN]ILLEGAL NUMBER FOUND IN
 LINE"LI:END
190 POKE AD%+BY,DA%
200 CH%=CH%+DA%
210 NEXT BY
220 READ VR%
230 IF CH%<>VR% THEN PRINT"[DOWN
]CHECKSUM ERROR FOUND IN LINE"LI
:END
240 AD%=AD%+8
250 NEXT LI
260 PRINT"[DOWN]STORAGE COMPLETE
 - DATA 100% CORRECT"
270 PRINT"[DOWN]INSERT ZEUS DISK
 & PRESS A KEY TO SAVE"
280 DO:GET KE$:LOOP UNTIL KE$
290 PRINT"[DOWN]SAVING ZEUS BASI
C LOADER PROGRAM..."
300 DSAVE "ZEUS LOADER"
310 PRINT"[DOWN]SAVING ZEUS SYST
EM CODE..."
320 FOR BY=0 TO 3:POKE 208+BY,PE
EK(43+BY):NEXT BY
330 POKE 43,1:POKE 44,16
340 POKE 45,26:POKE 46,22
350 DSAVE "ZEUS"
360 POKE 43,PEEK(208):POKE 44,PE
EK(209)
370 POKE 45,PEEK(210):POKE 46,PE
EK(211)
380 PRINT"[DOWN]SAVING COMPLETE
 - RESET MACHINE"
390 END
910 REM
920 REM ***********************
**
930 REM *
  *
940 REM * ZEUS MACHINE-CODE DATA
  *
950 REM *
  *
960 REM *  (START AT LINE 1000)
  *
970 REM *
  *
980 REM ***********************
**
990 REM
1000 DATA 12,16,0,0,158,32,52,49
,319
1010 DATA 49,48,0,0,0,32,136,216
,481
1020 DATA 160,99,162,39,152,157,
0,12,781
1030 DATA 157,24,13,157,48,14,16
9,100,682
1040 DATA 157,192,15,202,16,238,
24,160,1004
1050 DATA 10,162,1,24,32,57,216,
169,671
1060 DATA 210,160,19,32,229,18,1
60,4,832
1070 DATA 162,3,24,32,57,216,169
,231,894
1080 DATA 160,19,32,229,18,160,6
,162,786
1090 DATA 5,24,32,57,216,169,7,1
60,670
1100 DATA 20,32,229,18,165,52,56
,229,801
1110 DATA 50,201,64,144,8,162,25
3,169,1051
1120 DATA 32,160,20,208,6,162,64
,169,821
1130 DATA 35,160,20,142,204,17,3
2,229,839
1140 DATA 18,160,1,162,8,24,32,5
7,462
1150 DATA 216,169,39,160,20,32,2
29,18,883
1160 DATA 32,198,19,169,127,160,
20,32,757
1170 DATA 229,18,24,32,4,19,32,2
49,607
1180 DATA 18,160,19,162,8,24,32,
57,480
1190 DATA 216,169,183,160,21,32,
229,18,1028
1200 DATA 32,217,235,240,251,201
,80,240,1496
1210 DATA 35,201,83,240,31,201,8
5,240,1116
1220 DATA 27,201,27,208,235,169,
32,32,931
1230 DATA 75,236,32,198,19,169,2
24,160,1113
1240 DATA 21,32,229,18,24,32,4,1
9,379
1250 DATA 56,76,4,19,32,75,236,1
41,639
1260 DATA 24,22,169,47,32,75,236
,162,767
1270 DATA 0,169,183,160,21,32,22
9,18,812
1280 DATA 134,11,32,217,235,240,
251,166,1286
1290 DATA 11,201,27,240,200,201,
13,240,1133
1300 DATA 36,201,20,240,17,224,1
6,240,994
1310 DATA 233,230,203,32,75,236,
157,4,1170
1320 DATA 22,198,203,232,208,211
,224,0,1298
1330 DATA 240,216,169,188,160,21
,32,229,1255
1340 DATA 18,202,76,218,16,224,0
,240,994
1350 DATA 201,138,168,136,185,4,
22,201,1055
1360 DATA 42,240,191,201,63,240,
187,136,1300
1370 DATA 16,242,142,25,22,169,3
2,32,680
1380 DATA 75,236,169,0,133,214,1
33,215,1175
1390 DATA 133,216,169,87,141,26,
22,24,818
1400 DATA 32,43,19,32,198,19,169
,220,732
1410 DATA 160,20,32,229,18,169,2
,162,792
1420 DATA 8,160,2,32,19,244,173,
25,663
1430 DATA 22,162,4,160,22,32,12,
244,658
1440 DATA 32,83,239,32,74,19,162
,2,643
1450 DATA 32,24,237,32,198,19,16
9,39,750
1460 DATA 160,21,32,229,18,169,0
,160,789
1470 DATA 23,133,208,132,209,160
,0,162,1027
1480 DATA 254,32,217,235,145,208
,36,144,1271
1490 DATA 112,75,230,208,208,2,2
30,209,1274
1500 DATA 202,208,238,230,214,20
8,2,230,1532
1510 DATA 215,160,19,162,10,24,3
2,57,679
1520 DATA 216,160,3,166,214,165,
215,32,1171
1530 DATA 95,164,165,214,41,3,20
8,24,914
1540 DATA 230,216,160,19,162,12,
24,32,855
1550 DATA 57,216,160,3,166,216,1
69,0,987
1560 DATA 32,95,164,169,75,32,75
,236,878
1570 DATA 165,209,201,253,208,17
5,169,0,1380
1580 DATA 133,210,76,218,17,169,
255,133,1211
1590 DATA 210,169,2,32,93,238,16
```

```
9,0,913
1600 DATA 133,152,32,74,19,56,32
,43,541
1610 DATA 19,32,198,19,169,73,16
0,21,691
1620 DATA 32,229,18,174,25,22,16
9,44,713
1630 DATA 157,4,22,157,6,22,173,
24,565
1640 DATA 22,157,5,22,173,26,22,
157,584
1650 DATA 7,22,169,2,162,8,160,2
,532
1660 DATA 32,19,244,174,25,22,23
2,232,980
1670 DATA 232,232,138,162,4,160,
22,32,982
1680 DATA 12,244,32,83,239,32,74
,19,735
1690 DATA 32,198,19,169,114,160,
21,32,745
1700 DATA 229,18,169,0,160,23,13
3,217,949
1710 DATA 132,218,162,2,32,96,23
7,160,1039
1720 DATA 0,120,141,63,255,177,2
17,141,1114
1730 DATA 62,255,88,32,75,236,23
0,217,1195
1740 DATA 208,2,230,218,165,218,
197,209,1447
1750 DATA 208,231,165,217,197,20
8,208,225,1659
1760 DATA 169,2,32,93,238,169,3,
133,839
1770 DATA 153,169,0,133,152,32,7
4,19,732
1780 DATA 32,198,19,165,210,240,
15,169,1048
1790 DATA 148,160,21,32,229,18,2
4,32,664
1800 DATA 4,19,56,76,4,19,169,65
,412
1810 DATA 141,26,22,24,32,43,19,
32,339
1820 DATA 198,19,169,220,160,20,
32,229,1047
1830 DATA 18,169,2,162,8,160,2,3
2,553
1840 DATA 19,244,173,25,22,162,4
,160,809
1850 DATA 22,32,12,244,32,83,239
,32,696
1860 DATA 74,19,32,198,19,169,5,
160,676
1870 DATA 21,32,229,18,169,0,133
,217,819
1880 DATA 133,218,162,2,32,24,23
7,162,970
1890 DATA 254,32,217,235,202,208
,250,230,1628
1900 DATA 217,208,2,230,218,165,
218,197,1455
1910 DATA 215,208,236,165,217,19
7,214,208,1660
1920 DATA 230,76,108,17,141,238,
18,140,968
1930 DATA 239,18,160,0,185,255,2
55,240,1352
1940 DATA 6,32,75,236,200,208,24
5,96,1098
1950 DATA 169,98,160,20,32,229,1
8,24,750
1960 DATA 76,4,19,176,6,169,32,1
60,642
1970 DATA 3,208,4,169,198,160,2,
141,885
1980 DATA 15,255,140,16,255,169,
47,141,1038
1990 DATA 17,255,160,40,169,0,24
,105,770
2000 DATA 1,208,251,136,208,248,
140,17,1209
2010 DATA 255,96,8,32,198,19,40,
176,824
2020 DATA 6,169,158,160,20,208,4
,169,894
2030 DATA 188,160,20,32,229,18,3
2,249,928
2040 DATA 18,32,217,235,201,13,2
08,249,1173
2050 DATA 96,160,5,162,18,24,32,
57,554
2060 DATA 216,169,1,162,8,160,15
,32,763
2070 DATA 19,244,169,0,32,12,244
,32,752
2080 DATA 83,239,162,1,32,24,237
,32,810
2090 DATA 217,235,201,48,208,14,
169,1,1093
2100 DATA 32,93,238,169,0,133,15
2,169,986
2110 DATA 3,133,153,96,133,11,16
9,194,892
2120 DATA 160,21,32,229,18,165,1
1,32,668
2130 DATA 75,236,104,104,32,207,
204,32,994
2140 DATA 184,201,169,2,32,93,23
8,169,1088
2150 DATA 1,32,93,238,160,7,162,
20,713
2160 DATA 24,32,57,216,169,200,1
60,21,879
2170 DATA 32,229,18,32,249,18,16
9,206,953
2180 DATA 160,21,32,229,18,56,32
,4,552
2190 DATA 19,24,32,4,19,32,217,2
35,582
2200 DATA 201,13,208,241,96,160,
1,162,1082
2210 DATA 19,24,32,57,216,56,76,
4,484
2220 DATA 19,90,69,85,83,32,77,6
9,524
2230 DATA 71,65,67,79,80,73,69,8
2,586
2240 DATA 32,86,50,46,54,0,87,82
,437
2250 DATA 73,84,84,69,78,32,66,8
9,575
2260 DATA 32,77,46,82,32,69,86,6
9,493
2270 DATA 82,73,78,71,72,65,77,3
2,550
2280 DATA 49,50,47,56,56,0,83,79
,420
2290 DATA 70,84,87,65,82,69,32,8
2,571
2300 DATA 85,78,78,73,78,71,32,7
9,574
2310 DATA 78,32,67,66,77,32,0,43
,395
2320 DATA 52,0,67,49,54,0,84,89,
395
2330 DATA 80,69,47,70,73,76,69,7
8,562
2340 DATA 65,77,69,58,13,13,32,6
6,393
2350 DATA 76,79,67,75,83,32,67,7
9,558
2360 DATA 80,73,69,68,58,32,32,3
2,444
2370 DATA 32,45,13,13,32,75,73,7
6,359
2380 DATA 79,66,89,84,69,83,32,6
7,569
2390 DATA 79,80,73,69,68,58,32,4
5,504
2400 DATA 0,32,18,82,69,84,85,82
,452
2410 DATA 78,146,27,81,145,27,80
,157,741
2420 DATA 157,157,157,157,157,16
4,164,164,1277
2430 DATA 164,164,164,27,81,0,69
,78,747
2440 DATA 84,69,82,32,67,79,80,8
9,582
2450 DATA 32,70,73,76,69,45,78,6
5,508
2460 DATA 77,69,32,65,78,68,32,8
0,501
2470 DATA 82,69,83,83,0,32,73,78
,500
2480 DATA 83,69,82,84,32,83,79,8
5,597
2490 DATA 82,67,69,32,68,73,83,7
5,549
2500 DATA 32,65,78,68,32,80,82,6
9,506
2510 DATA 83,83,0,73,78,83,69,82
,551
2520 DATA 84,32,68,69,83,84,73,7
8,571
2530 DATA 65,84,73,79,78,32,68,7
3,552
2540 DATA 83,75,32,38,32,80,82,6
9,491
2550 DATA 83,83,0,32,32,32,32,45
,339
2560 DATA 32,83,69,65,82,67,72,7
3,543
2570 DATA 78,71,32,70,79,82,32,8
3,527
2580 DATA 79,85,82,67,69,32,70,7
3,557
2590 DATA 76,69,32,45,27,81,145,
27,502
2600 DATA 80,27,81,0,32,32,32,32
,316
2610 DATA 45,32,82,69,65,68,73,7
8,512
2620 DATA 71,32,83,79,85,82,67,6
9,568
2630 DATA 32,70,73,76,69,32,68,6
5,485
2640 DATA 84,65,32,45,32,0,32,32
,322
2650 DATA 32,32,45,32,76,79,65,6
8,429
2660 DATA 73,78,71,32,83,79,85,8
2,583
2670 DATA 67,69,32,70,73,76,69,3
2,488
2680 DATA 68,65,84,65,32,45,32,0
,391
2690 DATA 32,32,32,32,32,45,32,7
9,316
2700 DATA 80,69,78,73,78,71,32,6
8,549
2710 DATA 69,83,84,73,78,65,84,7
3,609
2720 DATA 79,78,32,70,73,76,69,3
2,509
2730 DATA 45,27,81,145,27,80,27,
81,513
2740 DATA 0,32,32,32,32,32,45,32
,237
2750 DATA 87,82,73,84,73,78,71,3
2,580
2760 DATA 68,65,84,65,32,84,79,3
2,509
2770 DATA 78,69,87,32,70,73,76,6
9,554
2780 DATA 32,45,0,32,32,32,32,32
,237
2790 DATA 45,32,67,79,80,89,73,7
8,543
2800 DATA 71,32,80,82,79,67,69,8
3,563
2810 DATA 83,32,67,79,77,80,76,6
9,563
2820 DATA 84,69,32,45,13,0,130,1
64,537
2830 DATA 132,157,0,32,157,157,3
2,157,824
2840 DATA 0,32,32,32,27,81,0,80,
```

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284
2850 DATA 82,69,83,83,0,17,32,84
,450
2860 DATA 79,32,65,67,75,78,79,8
7,562
2870 DATA 76,69,68,71,69,13,0,32
,398
2880 DATA 32,32,32,32,32,32,32,3
2,256
2890 DATA 45,32,80,82,79,71,82,6
5,536
2900 DATA 77,32,65,66,79,82,84,6
9,554
2910 DATA 68,32,45,27,81,145,27,
81,506
2920 DATA 17,17,0,0,0,0,0,0,34
2930 DATA 0,0,0,0,0,0,0,0,0
2940 DATA 0,0,0,0,0,0,0,0,0
2950 DATA 0,0,0,90,69,85,83,0,32
7
```

Multi-Precision Arithmetic

PROGRAM: MULTIPRES.LOAD

```
59   10 A=49151
A5   20 FORJ=1TO2157
A0   30 READB:IFB=-1THENPRINT"TOO
      FEW DATA ITEMS":END
E4   40 C1=C1+B:C2=C2+B*J
EC   50 POKEJ+A,B
BE   60 NEXT
CF   70 IFC1<>284305 OR C2<>30252
     774 THEN PRINT"CHECKSUM ERRO
     R"
4D   80 SYS49152:CLR
82   90 PRINT"ROUTINES INSTALLED"
     :END
B6   100 DATA169,0,160,30,153,166
     ,2,136,208,250
D4   110 DATA169,128,141,168,2,13
     3,56,169,160,141
77   120 DATA173,2,169,176,141,17
     8,2,169,224,133
69   130 DATA4,141,183,2,169,240,
     141,188,2,32
B5   140 DATA191,193,32,169,193,1
     60,0,132,3,169
F1   150 DATA0,145,251,145,253,14
     5,3,200,208,247
A3   160 DATA230,4,230,252,230,25
     4,169,160,197,254
CD   170 DATA208,233,169,83,141,8
     ,3,169,192,141
23   180 DATA9,3,96,32,115,0,240,
     4,201,35
9E   190 DATA240,3,76,231,167,32,
     103,192,169,0
0D   200 DATA76,174,167,162,0,160
     ,1,136,202,200
47   210 DATA232,177,122,16,3,76,
     8,175,56,253
72   220 DATA176,192,240,241,201,
     128,208,28,200,152
09   230 DATA24,101,122,133,122,1
     69,0,101,123,133
B1   240 DATA123,232,189,176,192,
     133,3,232,189,176
5B   250 DATA192,133,4,108,3,0,20
     2,160,1,232
05   260 DATA189,176,192,16,250,2
     32,232,232,189,176
DA   270 DATA192,208,188,76,13,19
     6,65,88,193,116
78   280 DATA194,65,89,193,132,19
     4,65,65,193,53
8E   290 DATA200,84,65,216,10,194
     ,84,65,217,53
F3   300 DATA194,84,89,193,223,19
     3,84,88,193,202
22   310 DATA193,67,88,193,82,196
     ,67,89,193,91
48   320 DATA196,83,88,193,232,19
     4,83,89,193,4
32   330 DATA195,77,88,193,100,19
     6,77,89,193,182
9F   340 DATA199,77,65,212,69,200
     ,73,78,216,94
1D   350 DATA200,68,88,193,6,198,
     68,89,193,253
B6   360 DATA197,76,196,125,193,7
     5,208,91,193,73
0A   370 DATA206,104,195,83,73,19
     3,191,199,80,82
8A   380 DATA193,27,199,69,84,193
     ,219,198,69,88
8F   390 DATA193,80,199,69,89,193
     ,114,199,69,88
A6   400 DATA217,148,199,0,32,121
     ,0,72,32,115
FB   410 DATA0,104,201,84,240,7,2
     01,68,240,6
D9   420 DATA76,8,175,162,1,44,16
     2,8,160,1
31   430 DATA169,1,32,186,255,32,
     158,173,165,97
48   440 DATA166,98,164,99,76,189
     ,255,32,48,193
95   450 DATA173,167,2,133,251,56
     ,109,169,2,170
51   460 DATA173,168,2,133,252,10
     9,170,2,168,169
67   470 DATA251,32,216,255,176,1
     ,96,170,76,55
DE   480 DATA164,32,77,195,32,48,
     193,169,0,32
58   490 DATA213,255,176,3,76,148
     ,194,170,76,55
F2   500 DATA164,162,16,32,61,195
     ,160,0,177,251
1D   510 DATA145,253,200,208,249,
     230,252,230,254,202
2E   520 DATA208,242,76,69,195,17
     3,172,2,133,251
26   530 DATA173,173,2,133,252,96
     ,173,187,2,133
11   540 DATA251,173,188,2,133,25
     2,96,173,167,2
72   550 DATA133,253,173,168,2,13
     3,254,96,173,174
F3   560 DATA2,141,169,2,173,175,
     2,141,170,2
C5   570 DATA32,169,193,32,191,19
     3,76,145,193,173
08   580 DATA179,2,141,169,2,173,
     180,2,141,170
18   590 DATA2,32,244,193,32,191,
     193,76,145,193
6D   600 DATA173,177,2,133,251,17
     3,178,2,133,252
15   610 DATA96,173,172,2,133,253
     ,173,173,2,133
B3   620 DATA254,96,173,169,2,141
     ,174,2,173,170
E5   630 DATA2,141,175,2,32,255,1
     93,32,31,194
A9   640 DATA76,145,193,173,167,2
     ,133,251,173,168
9C   650 DATA2,133,252,96,173,177
     ,2,133,253,173
C0   660 DATA178,2,133,254,96,173
     ,169,2,141,179
6A   670 DATA2,173,170,2,141,180,
     2,32,31,194
D1   680 DATA32,42,194,76,145,193
     ,248,32,61,195
0A   690 DATA160,0,24,177,251,113
     ,253,145,253,200
B2   700 DATA208,247,230,252,230,
     254,202,208,240,169
BE   710 DATA0,113,253,145,253,23
     0,253,208,2,230
75   720 DATA254,176,242,216,32,6
     9,195,96,32,191
46   730 DATA193,32,169,193,174,1
     75,2,232,32,74
66   740 DATA194,76,148,194,32,19
     1,193,32,244,193
19   750 DATA174,180,2,232,32,74,
     194,76,148,194
BA   760 DATA169,255,133,251,169,
     159,133,252,160,0
26   770 DATA169,0,209,251,208,25
     ,198,251,169,255
A8   780 DATA197,251,208,242,198,
     252,169,127,197,252
B9   790 DATA208,234,169,0,141,16
     9,2,141,170,2
71   800 DATA96,165,251,141,169,2
     ,165,252,56,233
D4   810 DATA128,141,170,2,96,248
     ,32,61,195,160
47   820 DATA0,162,16,56,177,253,
     241,251,145,253
65   830 DATA200,208,247,230,252,
     230,254,202,208,240
1A   840 DATA216,76,69,195,32,16,
     196,32,32,196
B9   850 DATA32,13,195,165,2,16,3
     ,32,13,196
CB   860 DATA32,169,193,32,191,19
     3,32,203,194,76
EB   870 DATA148,194,32,148,199,3
     2,232,194,76,148
5E   880 DATA199,160,255,162,16,3
     2,61,195,177,251
55   890 DATA209,253,240,16,144,7
     ,169,255,133,2
FC   900 DATA76,69,195,169,1,133,
     2,76,69,195
8F   910 DATA136,192,255,208,229,
     198,252,198,254,202
9A   920 DATA208,222,169,0,133,2,
     76,69,195,165
BB   930 DATA1,41,252,120,133,1,9
     6,165,1,9
4A   940 DATA3,133,1,88,96,173,16
     7,2,133,253
86   950 DATA173,168,2,133,254,16
     9,0,160,0,162
AD   960 DATA32,145,253,200,208,2
     51,230,254,202,208
F6   970 DATA246,96,32,77,195,169
     ,255,133,253,169
CB   980 DATA159,133,254,32,228,2
     55,240,251,201,20
67   990 DATA208,23,32,210,255,23
     0,253,208,240,230
D5   1000 DATA254,169,0,168,145,2
     53,169,160,197,254
1D   1010 DATA240,216,76,115,195,
     201,13,240,38,201
F4   1020 DATA48,144,216,201,58,1
     76,212,72,32,210
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CE  1030 DATA255,104,41,15,160,0,145,253,198,253
91  1040 DATA165,253,201,255,208,193,198,254,165,254
AE  1050 DATA201,127,208,185,76,8,175,32,210,255
A8  1060 DATA230,253,208,2,230,254,160,0,169,128
85  1070 DATA132,251,133,252,177,253,133,2,169,0
1F  1080 DATA145,253,230,253,208,2,230,254,165,254
D0  1090 DATA201,160,240,35,177,253,10,10,10,10
2D  1100 DATA5,2,145,251,169,0,145,253,230,253
42  1110 DATA208,2,230,254,165,254,201,160,240,13
64  1120 DATA230,251,208,2,230,252,76,206,195,165
30  1130 DATA2,145,251,32,148,194,96,76,8,175
9B  1140 DATA173,167,2,24,105,0,133,253,173,168
E9  1150 DATA2,105,15,133,254,96,24,173,172,2
7F  1160 DATA105,0,133,251,173,173,2,105,15,133
33  1170 DATA252,96,24,173,187,2,105,0,133,251
74  1180 DATA173,188,2,105,15,133,252,96,24,105
19  1190 DATA15,173,177,2,105,0,133,251,173,178
6F  1200 DATA2,105,15,133,252,96,32,16,196,32
09  1210 DATA32,196,76,13,195,32,16,196,32,64
2D  1220 DATA196,76,13,195,32,31,194,32,233,196
88  1230 DATA32,145,193,173,169,2,141,184,2,173
A1  1240 DATA170,2,141,185,2,32,16,196,32,32
D7  1250 DATA196,32,13,195,16,34,32,31,194,32
13  1260 DATA244,196,32,71,197,32,81,197,32,200
5A  1270 DATA196,173,174,2,133,101,173,175,2,133
2F  1280 DATA102,32,77,195,32,103,197,76,148,194
9C  1290 DATA32,169,193,32,244,196,32,71,197,32
69  1300 DATA92,197,32,49,197,173,169,2,133,101
0C  1310 DATA173,170,2,133,102,32,77,195,32,103
5E  1320 DATA197,76,148,194,173,182,2,133,5,173
D9  1330 DATA183,2,133,6,96,173,167,2,133,5
F3  1340 DATA173,168,2,133,6,96,173,182,2,133
98  1350 DATA251,173,183,2,133,252,96,173,182,2
17  1360 DATA133,253,173,183,2,133,254,96,162,16
05  1370 DATA32,61,195,160,0,132,2,173,187,2
23  1380 DATA133,253,173,188,2,133,254,177,251,72
65  1390 DATA10,10,10,10,5,2,145,253,104,74
B0  1400 DATA74,74,74,133,2,200,208,235,230,252
65  1410 DATA230,254,202,208,228,173,187,2,133,3
18  1420 DATA173,188,2,133,4,32,69,195,96,173
78  1430 DATA172,2,133,5,173,173,2,133,6,96
FA  1440 DATA173,177,2,133,5,173,178,2,133,6
10  1450 DATA96,173,167,2,133,97,173,168,2,133
72  1460 DATA98,162,3,189,172,2,149,99,202,16
14  1470 DATA248,96,162,3,189,182,2,149,99,202
99  1480 DATA16,248,96,160,0,32,61,195,177,99
EC  1490 DATA72,32,69,195,104,72,41,15,240,30
35  1500 DATA133,2,165,97,133,253,165,98,133,254
4B  1510 DATA165,5,133,251,165,6,133,252,174,175
82  1520 DATA2,232,232,32,74,194,198,2,208,228
A2  1530 DATA104,74,74,74,74,41,15,240,29,133
77  1540 DATA2,165,97,133,253,165,98,133,254,165
C8  1550 DATA3,133,251,165,4,133,252,174,175,2
C2  1560 DATA232,32,74,194,198,2,208,229,230,97
94  1570 DATA208,2,230,98,230,99,208,2,230,100
BE  1580 DATA198,101,169,255,197,101,208,151,198,102
26  1590 DATA16,147,96,160,0,152,162,16,145,251
31  1600 DATA200,208,251,230,252,202,208,246,96,32
60  1610 DATA180,193,76,213,197,32,169,193,76,213
11  1620 DATA197,32,244,193,76,213,197,32,222,196
62  1630 DATA76,213,197,32,148,199,32,6,198,76
CE  1640 DATA148,199,32,229,197,32,247,197,32,169
1B  1650 DATA193,32,244,196,56,173,169,2,237,174
38  1660 DATA2,141,193,2,173,170,2,237,175,2
95  1670 DATA16,3,76,13,196,141,194,2,24,173
28  1680 DATA167,2,109,193,2,141,167,2,173,168
84  1690 DATA2,109,194,2,141,168,2,24,173,193
F9  1700 DATA2,109,182,2,133,3,173,194,2,109
A9  1710 DATA183,2,133,4,169,0,133,151,32,48
7D  1720 DATA196,32,16,196,32,13,195,165,2,48
30  1730 DATA14,32,180,193,32,191,193,32,203,194
78  1740 DATA230,151,78,82,198,32,61,195,160,0
40  1750 DATA165,151,10,10,10,10,17,3,145,3
59  1760 DATA132,151,32,69,195,32,32,196,32,16
6D  1770 DATA196,32,13,195,165,2,48,14,32,169
86  1780 DATA193,32,191,193,32,203,194,230,151,76
D4  1790 DATA129,198,32,61,195,160,0,165,151,17
A6  1800 DATA3,145,3,132,151,32,69,195,206,167
9F  1810 DATA2,173,167,2,201,255,208,24,206,168
F6  1820 DATA2,173,168,2,201,127,208,14,169,0
06  1830 DATA141,167,2,169,128,141,168,2,76,148
70  1840 DATA194,96,198,3,165,3,201,255.208.2
67  1850 DATA198,4,76,82,198,32,233,196,32,31
52  1860 DATA194,32,253,198,173,185,2,174,170,2
E9  1870 DATA141,170,2,142,185,2,173,184,2,174
CE  1880 DATA169,2,141,169,2,142,184,2,96,162
EE  1890 DATA16,32,61,195,160,0,177,251,72,177
75  1900 DATA253,145,251,104,145,253,200,208,243,230
E3  1910 DATA252,230,254,202,208,236,76,69,195,172
BC  1920 DATA169,2,169,0,133,253,173,170,2,24
98  1930 DATA109,168,2,133,254,177,253,72,41,240
3C  1940 DATA74,74,74,74,24,105,48,32,210,255
D2  1950 DATA104,41,15,105,48,32,210,255,136,192
C6  1960 DATA255,208,228,198,254,48,224,169,13,76
D3  1970 DATA210,255,32,255,193,32,31,194,32,253
BC  1980 DATA198,173,175,2,174,170,2,141,170,2
9B  1990 DATA142,175,2,173,174,2,174,169,2,141
0C  2000 DATA169,2,142,174,2,96,32,42,194,32
47  2010 DATA31,194,32,253,198,173,180,2,174,170
56  2020 DATA2,141,170,2,142,180,2,173,179,2
CF  2030 DATA174,169,2,141,169,2,142,179,2,96
1B  2040 DATA32,42,194,32,169,193,32,253,198,173
34  2050 DATA180,2,174,175,2,141,175,2,142,180
47  2060 DATA2,173,179,2,174,174,2,141,174,2
1F  2070 DATA142,179,2,96,32,148,199,32,100,196
3B  2080 DATA76,148,199,32,241,174,32,163,182,133
33  2090 DATA2,32,77,195,169,255,133,253,169,159
82  2100 DATA133,254,160,0,177,34,230,34,208,2
A1  2110 DATA230,35,198,2,201,32,240,240,201,46
1D  2120 DATA240,236,201,43,240,232,201,69,240,35
86  2130 DATA201,48,144,28,201,58,176,24,41,15
A1  2140 DATA145,253,165,2,240,42,198,253,165,253
F5  2150 DATA201,255,208,204,198,254,165,254,201,127
B8  2160 DATA208,196,76,8,175,32,181,183,32,247
76  2170 DATA183,165,20,240,243,169,255,56,229,20
69  2180 DATA133,253,169,159,229,21,133,254,198,253
70  2190 DATA165,253,201,255,208,2,198,254,76,192
48  2200 DATA195,32,191,193,32,31,194,174,170,2
7F  2210 DATA232,32,74,194,76,148,194,32,31,194
66  2220 DATA32,244,196,173,187,2,133,253,173,188
60  2230 DATA2,133,254,32,31,194,32,253,198,76
4B  2240 DATA148,194,32,255,193,32,61,195,24,248
74  2250 DATA169,1,160,0,76,99,194,-1
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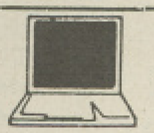
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B R E A K

Readers Problems

Though the Commodore 64 is one of the world's most popular microcomputers, it can be very difficult to find specific information about your particular machine.

At the *Your Commodore* office we receive literally hundreds of letters from you, our readers, on a wide range of subjects ranging from the simple 'Can you give me the telephone number for...', to the more complex 'I'm trying to write a program that uses a split screen. How do I do it?'

Unfortunately, the volume of mail received has become so great that it is impossible to answer every letter and still manage to publish a magazine each month.

For this reason we have felt it necessary to produce a number of guidelines for getting information from us:

1) We cannot guarantee to answer every letter sent to the magazine. Should it become apparent that a number of readers are suffering from the same problem, then we will reply to the letter via the Letters page.

2) A new helpline has been set up. This will be open for your queries on Tuesday and Thursday afternoons between 2.00pm and 4.00pm. We will not be able to deal with our telephone queries at any other time. If our technical adviser is not available when you ring, then a message will be taken.

3) If you are having problems with one of our listings, can you please let us know in writing. This will enable us to see if a number of people are having the same problem. When a common problem becomes apparent with a program, then a correction sheet will be issued. Enclose a self-addressed, stamped envelope and we will send you a copy of the correction sheet as soon as it is available.

We are sorry that it has become necessary to instigate these rules. However, we are sure that you will agree with us that the more time that we can spend making *Your Commodore* the most informative magazine around, the better.

For program queries write to:
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Twenty *Your Commodore* readers will be getting ready to take thier first flying lessons in Digital Integrations F16 fighter game. The twenty readers are all winners of our December 'Spot the Difference' competition.

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The lucky people in second and third place will receive a copy of *F16 Fighting Falcon* by Peter R Foster as well as their game.

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P.Cotton, Burton-On-Trent

Digital Integration has been informed of the winners and will be despatching the prizes.

Commodore Where Are You?

At the *Your Commodore* office we are repeatedly asked for the address and telephone number of Commodore U.K. Many people, after referring to their computer manuals, believe them to be based in Corby.

The Commodore plant at Corby was closed down some time ago. Reproduced here you will find the correct address for Commodore U.K.

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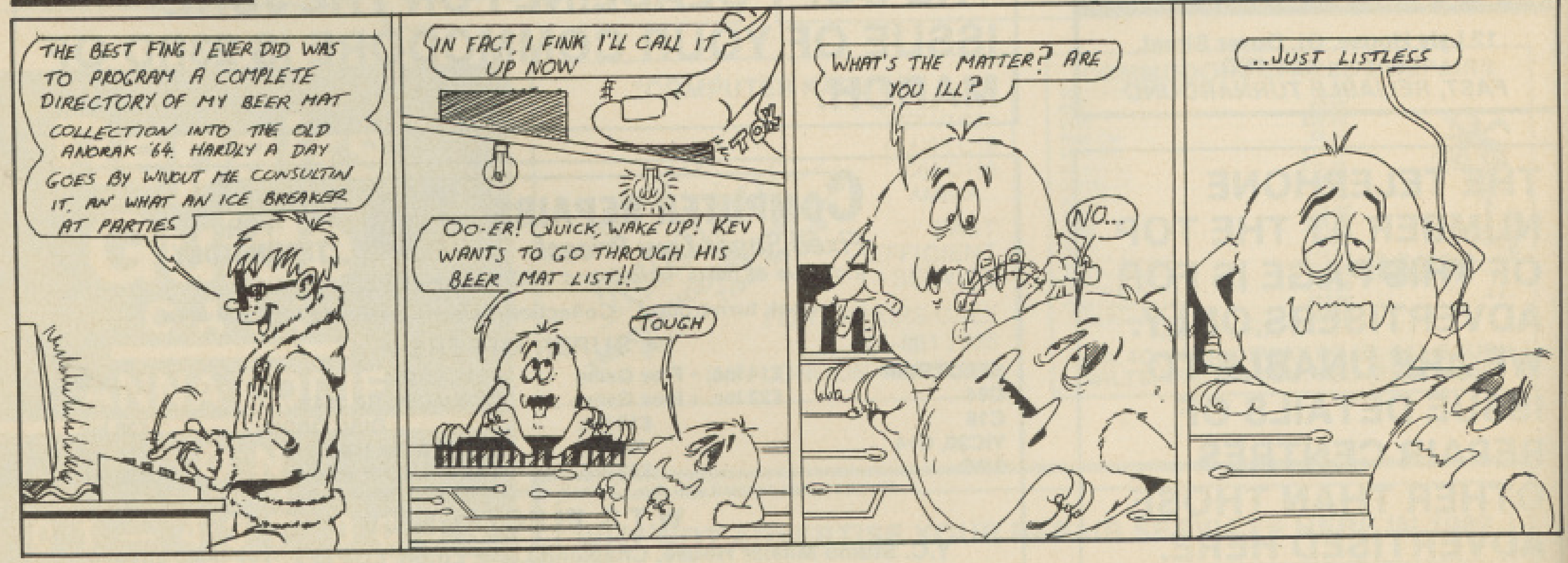
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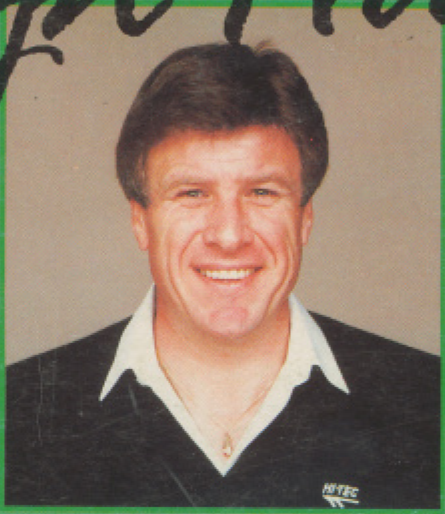
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